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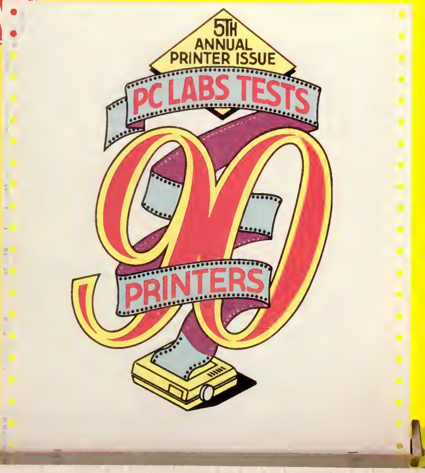
MAGAZIN

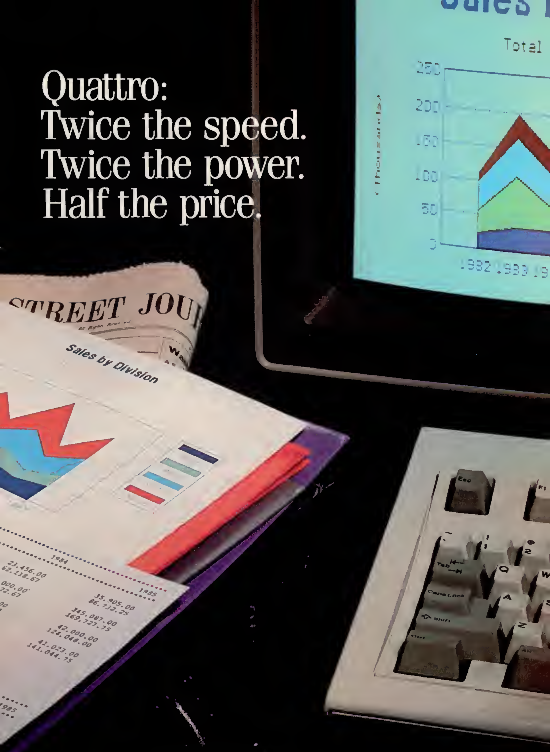
VOLUME 7 NUMBER 18
OCTOBER 31, 1988

30 Laser Printers
- Faster PostScript Output
- LCD Shutter: Better Than Lasers?

60 Dot Matrix Printers
- $200 to $4,500
- More Smarts, More Speed
- Finally—Easy Font Control

Plus: How Laser Engines Work

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124,048.00
41,023.00
141,044.75
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	Load File (15K cells)	15.9 sec.	19.8 sec
	Page Down (A1 to A1000)	12.2 sec.	17.4 sec
GRAPHICS	Presentation-quality Graphics	YES	NO
	Graph Types	10	6
	Integrated Graph Printing	YES	NO
	Full Graph Customization	YES	NO
	On-Screen Font Styles	11	1
	PostScript Support	YES	NO
VERSATILITY	User-modifiable Menus	YES	NO
	Menu Shortcuts	YES	NO
	Pull-down menus	YES	NO
	Point and Press Editing	YES	NO
	Automatic Installation	YES	NO
POWER	Macro Learn Mode	YES	NO
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With 20MB Hard Disk	$2,935
With 40MB Hard Disk	$3,080

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• 80286 CPU running at 20MHz • 512K of RAM (Expandable to 4MB on board) • 1.2MB floppy drive • Dual Floppy/hard disk controller • 101-key enhanced keyboard • 2 serial ports, 1 parallel port, game port • Clock/Calendar with battery back-up • Phoenix BIOS • Keyboard switchable processing speed

Basic System Price	$1,445
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EGA System	$2,035
With 40MB Hard Disk	$2,430

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$1,095

• 80286 CPU • (10MHz Optional) • Zero Wait State • 512K RAM (Expandable to 4MB on board) • Norton V3 SI rating: 15.3 • 1.2MB floppy drive • Dual floppy/hard disk controller • 101-key enhanced keyboard • 2 serial ports, 1 parallel port, game port • Clock/Calendar with 10 year battery life • Phoenix BIOS • Keyboard/software selectable processing speed

Basic System Price	$1,095
Monochrome System	$1,235
With 20MB Hard Disk	$1,485
With 40MB Hard Disk	$1,630
EGA System	$1,885
With 20MB Hard Disk	$1,935
With 40MB Hard Disk	$2,080

CPU 286/P

$1,895

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CIRCLE 163 ON READER SERVICE CARD

WHAT'S INSIDE

MagNetic personalities: Wendy Huang, Ross Greenberg, and Chris Barr in front of PC MagNet's predecessor, the IRS.

Photograph: Thom O'Connor

This year's fifth annual printer issue brings to almost 500 the total number of printers that have passed through PC Labs since *PC Magazine* first conceived the idea of the ultracomprehensive "blockbuster" issue back in 1984. And as PC Labs project leaders are wont to sigh, "what a long, strange trip it's been."

Over the past 5 years we've seen the birth, development, and improvement of laser printers (and the PostScript page description language to go along with them), the slow but steady decline of trustworthy yet noisy daisy wheel printers, and the maturation of a massive dot matrix printer market that continues to thrive in the face of competition from some intriguing upstart technology at its high end.

As you read John Dickinson's introduction to this year's printer reviews, you'll notice several references to a survey of readers we conducted to predict the course of the printer market. The key to our ability to contact thousands of readers literally overnight is PC MagNet.

PC MagNet is our exciting, new on-line information service that gives you access to our free utilities and lets you interact, through special forums, with *PC Magazine* editors and columnists, as well as PC Labs technical experts.

Chris Barr, former manager of the PC Magazine Interactive Reader Service, heads PC MagNet, and he has moved the files from the IRS to PC MagNet's utility database. Chris is busy readying *PC MagComm*, a free communications software program that will make it easy to connect with PC MagNet.

PC MagNet's utilities database is capably maintained by assistant manager Wendy Huang. Besides uploading every bit of code from each issue into the database, Wendy also manages the reader surveys and is always the first person to know the results.

Venture on-line into any of PC MagNet's forums and you'll undoubtedly run into Ross Greenberg, our primary sysop. Ross, a frequent contributor to *PC Magazine*, maintains the five reader forums. There you can converse with our editors, our contributors, and, of course, other PC MagNet members.

Another big bonus in MagNet: free programs. The utility in this issue is XPANDISK, an expanded-memory RAMdisk that can be adjusted without rebooting. XPANDISK—and all of *PC Magazine*'s other utilities—can be downloaded from PC MagNet.

For information on subscribing to PC MagNet, see the sidebar "XPANDISK by Modem" in the Productivity section. PC

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These unretouched print samples show the superior print quality of QMS-PS 810 over printers using first-generation print engines.

Introducing the PostScript laser printer that blacks out at high speeds.

The new QMS-PS® 810 can compose and print the most complex pages in record times, with richer, more saturated blacks than ever before. All with the desktop publishing power of Adobe PostScript®, and the superior print know-how of QMS, an industry leader.

Under the hood QMS ASAP™ (Advanced System Architecture for PostScript) is proprietary technology that helps eliminate the hardware bottlenecks that hinder other PostScript printers. As a result, QMS-PS 810 boasts processing speeds remarkably faster than other PostScript printers in its class. And faster output means greater productivity. In addition, the QMS-PS 810 laser printer's new Canon® SX® print engine covers solid areas and prints fine detail better than previous-generation engines.

The new 8-page/minute QMS-PS 810 laser printer

Fast start, strong finish You can adorn your documents with one or all of the 35 Adobe typefaces. Thanks to PostScript, there's an infinite number of font variations available. You can also make type as large or as small as you want. And put it anywhere on the page. In fact, with PostScript you enjoy total control over the design of your page. It gives you the complete desktop publishing power to do things that would otherwise be virtually impossible. So you get high-quality output exactly how you want it.

Along with PostScript, the HP LaserJet+™, Diablo® 630 and HP-GL™ printer emulations are added for your non-PostScript software.

The QMS-PS 810 laser printer is easy to use, maintain, and comes with a one-year warranty. It's available from Laser Connection dealers. Laser Connection is a sales and marketing subsidiary of QMS. For the dealer nearest you call **1-800-523-2696**.

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CIRCLE 259 ON READER SERVICE CARD

VOLUME 7 NUMBER 18

PC MAGAZINE

COVER STORY

The 5th Annual All-Printer Review

John Dickinson/ Since last year's printer issue, the printer market has headed in a progressive new direction. Better performance, sleek designs, improved graphics capabilities, and competitive prices are making it more exciting, yet more difficult, to find the one printer that's just right for your needs 92

The PC Magazine Printer Guide

Everything you need to know about this year's printers—printer type, price, maximum paper size the printer can handle, text and graphics speed test results, output quality, and formatting features—is distilled into this indispensable 16-page guide. Use it for easy reference as you make your buying decisions.

Laser printers 96
Dot matrix printers......... 194

Citizen Overture 110
Laser
$1,995
Paper size
LET
LEG
TEXT SPEED (ppm)
0
12
GRAPHICS TEST (bytes/sec)
0
4000
FORMATTING
Center
Justified
Propert
DblWide
VForm
Compr
VLine
HorzTab
VTab
GRAPHICS TEST
C. Itoh Jet-Setter II
Laser
$2,195
Paper size
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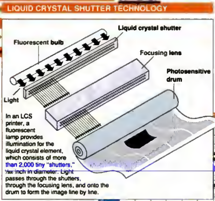
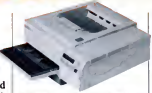
LEG
TEXT
GRAPHICS TEST

PC Magazine's comprehensive printer guide, page 96.



In an LCS printer, a fluorescent lamp provides illumination for the liquid crystal element, which consists of more than 2,000 tiny "shutters," $\frac{1}{300}$ inch in diameter. Light passes through the shutters, through the focusing lens, and onto the drum to form the image line by line.

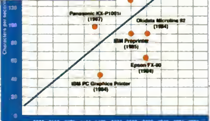
A new page printer technology competes with lasers, page 14



The Brother HL-8 offers five printer emulations, page 123.

Laser Printers: Another Year Older, Another Year Wiser

John Dickinson/ You don't have to spend an outrageous amount of money to join the laser printer club now that a wave of quality lasers and LCD shutter machines is breaking into the sub-$2,000 price range. In the midrange, the popular HP LaserJet Series II finds itself up against some stiff competition as everyone scrambles to beat Hewlett-Packard at its own game. Higher-end lasers offering speeds of up to 18 pages per minute, paper capacity of up to 750 sheets, or PostScript compatibility will cost much more, but their power can be seductive..................... 109



A price/performance map for 9-pin printers, page 227.

Dot Matrix Printers: The Market Matures

John Dickinson/ You are sure to find at least one dot matrix printer to satisfy your printing needs from the wide selection in this year's crowd. Quality construction, lower noise levels, easier paper handling, and sophisticated font control are just some of the improvements you'll spot this year. As you read the reviews and examine our historical "Bang for the Buck" chart, you'll discover that dot matrix printer manufacturers are squeezing more performance into their machines while squeezing less money out of your wallet.................. 225

Index to Printer Reviews (1984–1988)

A complete listing of all the printers reviewed by *PC Magazine* that are still on the market today, including this year's models, along with tested speeds, current price information, and a reference to each original review 339

EDITORIAL PRODUCT INDEX

The complete listing of products (other than printers) reviewed in this issue, plus a quick reference to utilities, programs, and tips in the Productivity section........ 498

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David Herbick
Output: Inset Systems
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Roberto Brosan

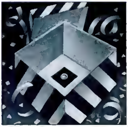
FIRST LOOKS

AFTER HOURS

EGA Chess **tries to checkmate the competition, After Hours, page 508.**

PRODUCTIVITY

VIEWPOINTS



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BPA

WE HAVE MET THE COMPETITION. AND IT IS US.

Some nine-wire dot matrix printers hide from the competition. Not the new Citizen™ MSP-50.

With the ability to handle all types of paper, top or bottom feed, and a convertible push or pull tractor, it figured it was the best. However, another printer had designs on the title.

So the MSP-50 relied on its high speed, up to 300 cps, to crush the competition. But it wasn't enough. Feature by feature these two contenders battled. Quiet mode. 240 dpi graphics. Color capability. Choice of fonts. Front panel feature controls. Even compatibility with most major software. They were equal. Finally, the MSP-50 put its 80-column print width on the line. Unfortunately, the other machine offered 136.

What was the other machine? The new Citizen MSP-55. Which just goes to prove that if you want to be considered one of the best, you have to be a Citizen in good standing.

For more information call 1-800-556-1234, Ext. 34. In California call 1-800-441-2345, Ext. 34.

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CIRCLE 114 ON READER SERVICE CARD

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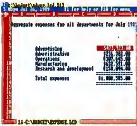
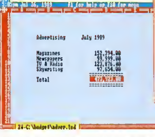


Aggregate expenses for all departments for July 198

Advertising	$473,923.00
Administrative	$236,382.00
Operations	$307,645.00
Manufacturing	$632,591.00
Research and development	$158,044.00
Total expenses	$1,008,585.00

1$-C:\BUDGET\EXPENSE.LCD

Fig. 1 Let's get the detail on those ad costs. Just move the widebar to that cell and press one key (Grey +).

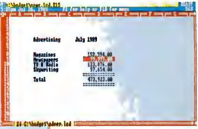


Advertising July 1989

Magazines	152,394.00
Newspapers	99,999.00
TV & Radio	123,876.00
Skywriting	97,654.00
Total	473,923.00

2$-C:\budget\adver.lcd

Fig. 2 Here we are, instantly. Notice the lower left corner showing we are on level 2. You can go down or up.



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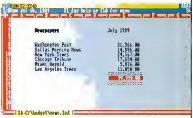
TV & Radio	123,876.00
Skywriting	97,654.00
Total	473,923.00

2$-C:\budget\adver.lcd

Fig. 3 We want more detail, so let's go to Newspapers. Just press the Grey+ key.



SUM(E2:E14)

Newspapers July 1989

Washington Post	21,966.00
Dallas Morning News	14,886.00
New York Times	24,567.00
Chicago Tribune	17,654.00
Miami Herald	9,876.00
Los Angeles Times	11,050.00

3$-C:\budget\news.lcd

Fig.4 Now, instantly we are on level 3. Each level is a different spreadsheet. You could now move to the New York Times and see the detail on that figure. There is no limit to the levels you can go. Move right down to transaction level if you like.

What Makes Lucid 3-D So Special

In the screen examples you can see Lucid is really three dimensional. Any cell of the spreadsheet can contain a complete other spreadsheet that you can access with a single keystroke. It is as simple as the pictures show. And you don't have to write formulas to do that.

All you do is go look at the other file, navigating through easy, point and shoot directories. When you come back up (with one key) the link is made automatically for you.

Everything about Lucid works that way. Users say *"It is so intuitive that I really don't need a manual."* That's because we use something we call a visual command menu. Jim Seymour, the noted PC columnist, talking about Lucid in a recent article said that, *"If there ever was an interface idea so good it ought to be stolen and widely used, this is it."*

What he was talking about is a new menu approach that follows a simple design concept: it is easier to recognize than it is to remember. As choices are made on a menu that take you to lower levels you always can see exactly where you came from and where you are going. The complete menu path is always visible. You cannot get lost several levels down. This means you never have to remember a command, you just flow right to it.

Plus, no matter where you are on a menu or what you are doing, just press function key F1, and you will get a help screen specific to that command or action. Or if you want to know about any subject you can pop up an index of over 600 topics and select the one you want.

Notepad Behind Every Cell

Another 3-D feature is that any cell can also contain a multiple page note that you instantly access with a single keystroke. You can write notes, memos or letters that relate to your work, save them as individual files and even print them separately or with your spreadsheet.

> "I've been calling it an 'Everyman's Spreadsheet',
> and I think that's how the market will position it. It's
> much more than an inexpensive alternative to 1-2-3."
>
> **Jim Seymour, Columnist, PC Magazine, PC Week**

Speed

Lucid 3-D™ is truly revolutionary. It is fast, fast, fast! It is incredibly quick in performing calculations because it doesn't recalculate every cell every time you insert an entry. Instead, it only recalculates the specific cells that are affected by your change. This is called minimal recalc. Lucid also has a remarkable innovation called background recalc in which you are given control of the cursor the moment calculations affecting your viewing screen are completed. Other calculations you don't see continue on in the background during the next commands. The end result of this powerful combination is you rarely wait for a recalculation with Lucid. You find out what instantaneous is all about.

Lucid Learns

Lucid 3-D™ also lets you teach it in any combinations of keystrokes so that involved sequences can be done with single keys. Plus more than just remembering keystrokes, Lucid allows you to create Macros with loops, procedures and conditional branching amazingly all done automatically with simple menus. You can create your own menus that show the new features you have taught it. Another great feature is you can make your custom menus work like Lucid where one choice can take you

lete other spreadsheet with a single key.

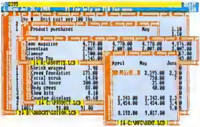
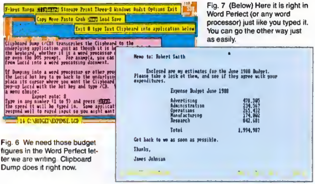


Fig. 5 **Of course, Lucid does multiple windows. Notice, you can simultaneously open windows in different directories, different drives, even down as many 3-D levels as you like. No one else can do that.**


F-keys Range Clipboard Storage Print Three-D Windows Audit Options Exit
Copy Move Paste Grab Dump Load Save
Exit 0 type Text Clipboard into application below
16 C:\BUDGET\EXPENSE.LCD

```
Clipboard Dump (/CD) transcribes the Clipboard to the
underlying application just as though it is b
the keyboard, whether it is a word processor
or even the DOS prompt.  For example, you can
from Lucid into a word processing document.

If Dumping into a word processor or other pro
the Lucid hot key to go back to the underlyin
place its cursor where you want the Clipboard
pop-up Lucid with the hot key and type /CD.
a menu choice:
        Export rate: 8
Type in any number (1 to 9) and press
the speed it will be typed in.  Some applicat
respond well to rapid input so you might want
```

```
Memo to: Robert Smith

     Enclosed are my estimates for the June 1988 Budget.
Please take a look at them, and see if they agree with your
expenditures.

                 Expense Budget June 1988

                 Advertising                  478,305
                 Administration               234,567
                 Operations                   265,432
                 Manufacturing                174,002
                 Research                     842,601

                 Total                      1,994,907

Get back to me as soon as possible.

Thanks,

James Johnson
```

Fig. 6 We need those budget figures in the Word Perfect letter we are writing. Clipboard Dump does it right now.

Fig. 7 (Below) Here it is right in Word Perfect (or any word processor) just like you typed it. You can go the other way just as easily.

down a level to a whole new set of choices. What's nice is that they will work from one spreadsheet to another.

Mouseability

Lucid 3-D™ was designed for both keyboard enthusiasts and mouse lovers alike. You can take your pick. Designed around the mouse from the ground up, the interface is smooth and natural. You select files to load from directory lists. Everything is point and click. What's more, any Lucid 3-D™ menu selection can be "moused" and the response time is "right now" instead of the sluggish "a little bit behind you" feel of add-on mouse menu systems like those you've seen with 1-2-3.

A window pops up with a library of function names you can page through with the mouse. Select, click and it's in the formula with no typing required. You even have a label window that you can fill (from the keyboard) with favorite labels and names so that you can insert them later with the mouse. There's even a pop-up calculator to insert numbers so you don't have to go to the keyboard very often.

It really permits that feeling of becoming one with your work. Lucid 3-D™ has windows of user defined range names as well as the macros named by the user that can be selected just by pointing and clicking. Icons that are easy to grab with the mouse let you resize and move the spreadsheet window with the ease you would expect. Plus you can go anywhere on the sheet by moving the mouse and clicking on the spreadsheet borders. And remember, Lucid is designed so that any of those features are done with or without the mouse easily and quickly.

Audit

When you are staking a big decision on information gained from a spreadsheet you need to be certain that you have made no mistakes. Lucid 3-D™ offers five audit displays and printouts.

Even if you don't plan to abandon 1-2-3, Lucid makes sense. Files are converted between them with ease so there's not an interoffice compatibility problem. This means you can have the power and fun of Lucid 3-D™ without having to upset your present systems.

We are excited about Lucid 3-D™. But don't take our word for it, take us up on our 60 day offer.

Call us on our order line number and we will ship your order the very next day. This $149 offer will end as soon as our dealer network is fully stocked. But in the mean time we invite you to try Lucid as part of our "spread the news" campaign. Just pick up the phone and call us. We accept all major credit cards or you can order COD.

For a limited time

$149

Lucid™ 3-D

Winner of PC Magazine's 1987 Award for Technical Excellence

Ask your dealer or call
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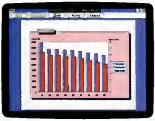
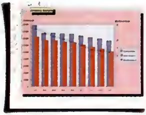
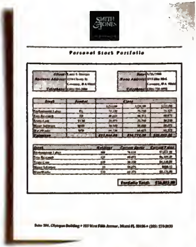




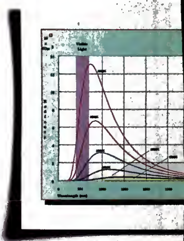
Don't waste any more time, or paper. Preview your ideas before you print them out.



SMITH JONES

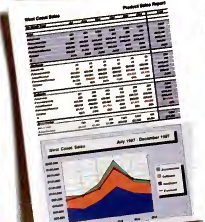
Personal Stock Portfolio

Portfolio Total:



Purchase Form

As you can see, Microsoft can make all kinds of HP printers and plotters look their best.

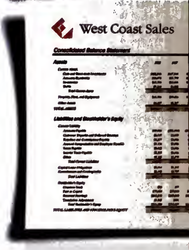


West Coast Sales

Product Sales Report

West Coast Sales

July 1987 - December 1987



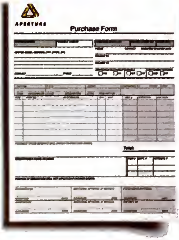
West Coast Sales

Consolidated Balance Statement

Assets

Liabilities and Stockholder's Equity

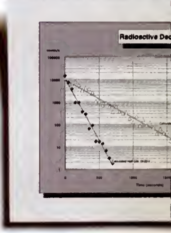
Personalize your LaserJet Series II Printer with HP fonts and memory boards.



APERTURE

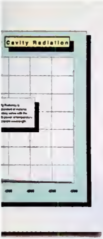
Purchase Form

Total:



Radioactive Dec

These documents were brought to you by Microsoft Excel, Microsoft Windows, and the HP LaserJet Series II, PaintJet and DeskJet printers.



Two world leaders develop highly explosive material.

Hewlett-Packard and Microsoft just took the simple act of communication and turned it into something a bit more powerful.

Illumination.

Because to us, anything worth presenting in a spreadsheet is worth presenting more clearly, more concisely, and more forcefully. Which is exactly what Microsoft® Excel and the Hewlett-Packard® LaserJet Series II® printer let you do.

With this powerful combination of software and printer, now it's easier to take common data and make it look anything but common. With incredibly flexible font styles, font sizes, borders and shading. Incorporated into spreadsheets, charts, tables and forms that instantly make your data say more. Your numbers add up to more. Your facts, figures and ideas mean more.

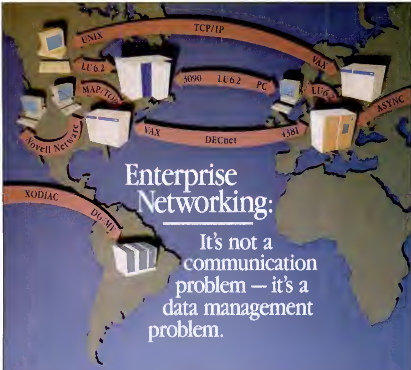
And of course, HP® desktop plotters and printers, from the ColorPro® plotter to the PaintJet,® DeskJet™ and LaserJet Series II printers, can unleash the potential power inside every box of Microsoft Excel. And vice versa.

To witness a whole new world of spreadsheet output, call us at (800) 541-1261, Dept. 158 for a free copy of our booklet, "Of Power And Printers." Or simply go to your dealer. And see firsthand what happens when two explosive elements get together.

And the chemistry's just right.

HP LaserJet Series II Printer

Microsoft®



Enterprise Networking:

It's not a communication problem — it's a data management problem.

ORACLE® isn't just the world's best data management system, it's the *only* system that runs on mainframes, minicomputers and PCs—the *only* system that can integrate all your computers and all your data into a single enterprise-wide network.

You've invested a lot of money in communication controllers, satellite links and wire to connect your computers. Yet, to access data located on any computer other than the one to which you are directly connected, you still have to:

- Know which computer has the data you want
- Know how to use a terminal emulator to log onto that computer
- Know how to use a file transfer program to bring your data over

Enterprise networking must provide easy access to data anywhere in the network. Only ORACLE makes this possible, today. Only ORACLE runs on all your computers, today. Only the ORACLE distributed DBMS provides you with transparent access to data on every computer on the network.

If your users know nothing about communications or networks, ORACLE will help keep it that way.

SQL*Star™ is Oracle's open systems architecture for enterprise networking. It allows you to integrate all your computers, operating systems, networks—even different DBMSs—into a single unified computing and information management environment. With SQL*Star, your users can unite information on PCs, minis and mainframes across all your local and wide-area networks. ORACLE's open systems design even allows you to transparently access IBM's SQL/DS and DB2.

If you purchase or write software that interfaces at the wrong level (lower than OSI Level 7), you have a network-dependent application. Applications built using ORACLE are network independent.

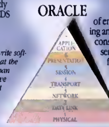
ORACLE solves problems at the right level

Are you unsure which or how many networks your company will ultimately settle on? Do you have LU6.2, DECnet, TCP/IP, asynchronous lines, 3270 data stream, MAP/TOP, Novell Netware, Banyan VINES, LAN Manager, 3COM 3+? ORACLE supports them all.

Has your network changed in the past? Might it change in the future? Applications built using ORACLE won't change a bit.

Oracle Corporation is the world's largest supplier of data management software and services, and the only supplier of enterprise-wide networking and data sharing. Oracle's consulting and support services will insure trouble-free operation anywhere in the world.

To register for the next free ORACLE seminar in your area, call or write today.



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TRBA

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	Los Angeles	Sep 15, Oct 18, Nov 15
	Oakland	Oct 6
	Sacramento	Sep 22, Nov 10
	San Diego	Sep 8 Oct 6, Nov 3
	San Francisco	Sep 14, Oct 11 Nov 9
	San Jose	Sep 20, Oct 26, Nov 17
CO	Denver	Sep 22, Oct 27
	Colorado Springs	Oct 25
CT	Farmington	Oct 4
	New Haven	Sep 8
	Stamford	Nov 15
DC	Washington *(Federal)*	Sep 16, Oct 21, Nov 18
FL	Ft Lauderdale	Oct 18
	Jacksonville	Oct 19
	Orlando	Sep 14
GA	Atlanta	Sep 7, Oct 5, Nov 9
HI	Honolulu	Sep 13
IA	Des Moines	Sep 13, Nov 10
ID	Boise	Oct 5
IL	Chicago	Sep 15, Oct 11, Nov 16
	Springfield	Sep 14 Nov 9
IN	Indianapolis	Oct 13, Nov 17
KS	Wichita	Sep 13
KY	Lexington	Sep 14
	Louisville	Oct 12
LA	New Orleans	Oct 28
	Shreveport	Oct 15
MA	Boston	Oct 12
	Burlington	Nov 18
	Springfield	Oct 12
MD	Bethesda *(Commercial)*	Sep 21
	Baltimore	Oct 19
ME	Portland	Oct 5
MI	Detroit	Sep 13, Oct 4, Nov 8
	Grand Rapids	Oct 12
MN	Minneapolis	Sep 27, Oct 19, Nov 10
MO	Kansas City	Sep 14, Oct 18
	St Louis	Sep 6, Oct 6, Nov 7
NC	Charlotte	Oct 20 Nov 17
	Raleigh	Sep 15, Nov 2
	Winston-Salem	Oct 5
NE	Omaha	Oct 4
NH	Concord	Sep 20
NJ	Iselin	Sep 15, Oct 13, Nov 17
	Princeton	Sep 15, Oct 4, Nov 22
NM	Albuquerque	Sep 29
NV	Las Vegas	Sep 22, Nov 10
NV	Albany	Sep 20, Nov 9
	Buffalo	Oct 4
	Long Island	Sep 20, Oct 19, Nov 16
	New York City	Sep 14, Sep 28, Oct 12, Oct 26 Nov 9, Nov 16
	Rochester	Sep 14, Nov 2
OH	Akron	Sep 20
	Cincinnati	Sep 15
	Cleveland	Oct 19
	Columbus	Sep 22
OK	Oklahoma City	Sep 13
	Tulsa	Oct 25
OR	Portland	Sep 8 Nov 15
PA	Harrisburg	Sep 26
	Philadelphia	Sep 19, Oct 26, Nov 18
	Pittsburgh	Oct 26
	Valley Forge	Sep 8, Nov 10
RI	Providence	Sep 22
SC	Charleston	Oct 5
	Columbia	Nov 16
	Greenville	Oct 19
TN	Memphis	Sep 14
	Nashville	Nov 9
TX	Amarillo	Sep 20
	Austin	Oct 20
	Dallas	Sep 7, Oct 4 Nov 2
	Ft Worth	Nov 9
	Houston	Sep 8, Oct 6, Nov 10
	Midland	Oct 19
	San Antonio	Oct 21
UT	Salt Lake City	Sep 20, Nov 9
VA	Norfolk *(Federal)*	Oct 4
	Richmond	Oct 6, Nov 1
VT	Burlington	Sep 28
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	Spokane	Nov 3
WI	Madison	Oct 5
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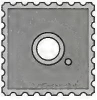
PCMAGAZINE

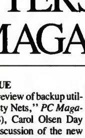
LETTERS TO PC MAGAZINE



SPEED IS THE ISSUE

In your comparative review of backup utilities ("Software Safety Nets," *PC Magazine*, May 31, 1988), Carol Olsen Day gave an excellent discussion of the new features incorporated into *Fastback Plus*.

However, benchmark-test results obtained by us and by other independent testing laboratories were nearly four times faster than those you published. Through conversations with your staff, it has become apparent that PC Labs did not run the INSTALL program that we provide. Failure to run this program results in *Fastback Plus* operating in its slowest mode.



SOFTWARE SAFETY NETS

This "safety net" is established in the interest of data integrity for the 5 percent of PCs that are not capable of running at our highest DMA speed setting. The performance difference between our High and Low speed setting for DMA is a factor of two. Had PC Labs run the installation procedure, your benchmark-test results would have been *four times faster*.

Barry L. Bellue, Sr.
President
Fifth Generation Systems
Baton Rouge, Louisiana

It's true that Fastback Plus *offers a choice of installation options and our results were based on the default. When we ran our tests at the top DMA setting,* Fastback Plus *backed up the 10-million-byte test file in 160 seconds (155 seconds with error checking off), which is faster than any of the other 16 programs we reviewed.* Fastback Plus'*s restore time was also fastest among the group when set at the high DMA transfer option.*—Ed.

OIL THE FACTS

John C. Dvorak is to be congratulated for his interesting analysis of the economics of memory chip prices ("Repent! The End Is Near," *PC Magazine*, June 14, 1988). He clearly oversteps his area of expertise, however, when he compares the economics of computer chip production with oil production.

Enough silicon exists to build a virtually unlimited supply of computer memory chips. Oil, on the other hand, is an increasingly scarce commodity in finite supply.

Donald H. Judson
Midland, Texas

WYSIWYG IS FOR LIGHTWEIGHTS

Arguing about user interface can produce more heat and less light than arguing about politics and religion, but technical readers should consider if your article "Scientific Word Processors: Formulas for Success" (*PC Magazine*, July 1988) is not pointing them in the wrong direction.

In my opinion, a technically trained user who needs to write a great deal of math will find that powerful programs such as *TeX* and *Lotus Manuscript* will save time in the long run. The simpler WYSIWYG interface is better designed for light use.

Lance D. Drager
Texas Tech University
Lubbock, Texas

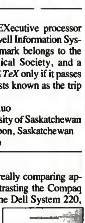
The *TeX* developed by Dr. Donald Knuth should not be referred to as *TEX* ("Scientific Word Processors: Formulas for Success"). The proper way to refer to *TeX* in a computer file is by lowercasing the "E."

TEX is the Text EXecutive processor developed by Honeywell Information Systems. The *TeX* trademark belongs to the American Mathematical Society, and a program can be called *TeX* only if it passes a set of predefined tests known as the trip test.

Peter Kuo
University of Saskatchewan
Saskatoon, Saskatchewan
Canada

MORE FOR LESS

I don't think you're really comparing apples to apples in contrasting the Compaq Deskpro 386S with the Dell System 220, an AT-class machine ("Less is More," *PC Magazine*, August 1988). A better comparison could be made between the Deskpro 386S and the Dell System 310, a full-fledged 386. The 310 will run circles around the Deskpro 386S and costs $1,000 less.



LESS IS MORE

Ralph Smith
Christiansburg, Virginia

The target market for the 80386SX chip and the Compaq Deskpro 386S is the midrange, 286-based PC market, not the high-end, 386-based market. As a result, our performance comparisons between 386SX-based systems and 286 systems are valid.

Though your cost comparison is correct on a list price basis, it is flawed when dealing with actual purchase prices. You can get a discount on a Compaq but normally not on a Dell.—Ed.

■ LETTERS

John Dickinson's reference to Compaq as "the first PC maker to bring you 80386 power" is inaccurate ("Less is More"). Corvus Systems had the first 80386 machine developed, stocked, and actually on the market.

Jeffrey K. Boswell
Seattle, Washington

A HARVARD EDUCATION

Based on your Editor's Choice award, I purchased a copy of *Harvard Graphics* ("Business Graphics Software: At the Top of the Charts," *PC Magazine*, March 15, 1988). To my surprise, your glowing comments ignored some serious shortcomings.

The chart you see on the screen can look very different on paper. Titles that fit into the allowed screen length may not print completely.

Add this to the lack of a sorted chart directory, the inability to rename existing charts or temporarily exit to DOS, and the poorly organized manual, and what you have is one tremendously overrated piece of software.

William Spitz
Princeton, New Jersey

USING WORD WITH STYLE

John Dickinson's excellent step-by-step introduction to *Microsoft Word*'s style sheets was a little shy on useful generalities ("Formatting Text with Style," *PC Magazine*, August 1988).

FORMATTING TEXT WITH *Style*

When a new style sheet is attached, text is reformatted according to the Usage and Variant, even if the new key code is different. Therefore, the first step to using more than one stylesheet should be to standardize the Variants.

A significant difference between direct and style formatting is that paragraph styles include a default font. Character styles usually should match the default font of the paragraph.

The character style takes precedence over all the paragraph's default character formatting. To reverse the order of priority, simply attach a style sheet that omits the character styles. The text will "remember" its original character style when reattached to the original stylesheet.

Allan G. Fries
Seattle, Washington

MUSH ISN'T JUST FOR DOGSLEDS

In your review of the Hyundai Super-286C ("Nine ATs Compete for Market Share," *PC Magazine*, July 1988), you criticized the texture of the accompanying keyboard, which is manufactured by BTC.

At BTC, we feel that keyboards with a strong tactile feedback tend to tire the fingers and we have designed our keyboards with this in mind. The casual user may describe our feeling as "mushy," but the professional will come to appreciate our keyboard.

■ Your comments on *Harvard Graphics* ignored some serious shortcomings.

Meui Hsu
BTC Corp.
Fremont, California

BEATING UP ON IBM

In a recent letter, Kerry Q. Cole criticized *PC Magazine* for alleged "IBM bashing" (Letters, *PC Magazine*, August 1988).

Mr. Cole seems to have forgotten the IBM PC*jr* and Model 50 fiascoes, which were bought by people who did not look further than the familiar logo. Keep telling it like it is and maybe someday people will shop for computers with their brains and not just through the IBM ads.

Allan S. Joffe
Dresher, Pennsylvania

A RECHARGED TURBO

In reviewing our HEI Turbo 386 ("20-MHz 386s: Hustle with Muscle," *PC Magazine*, June 28, 1988), Winn L. Rosch mentioned several design weaknesses that HEI had already recognized.

Our current 386s do have 32-bit expansion potential and a very efficient 80387

The Bus Stops Here!

Introducing Wells American's CompuStar* Multi-Bus Business Computers. The world's first and only multi-processor, convertible bus™ microcomputers.

Ask any computer expert about what type of system you should buy nowadays and you'll likely get a "pass the bus" response. Something like — "Well, uh, the PC/AT* bus is your best buy but, then again, the new PS/2* bus may become the next industry standard." Great advice, right? If trying to decide on a processor weren't tough enough, now you're expected to pick a bus, too.

RELAX, NOW THERE'S COMPUSTAR!

The all new CompuStar* from Wells American not only lets you interchange microprocessors, you can also mix and match buses — a PC/AT bus, a PS/2 bus or. . .both. As your computing needs change, simply snap in a new processor or add an extra bus. You'll never again have to worry about buying the *wrong* computer system!

FOUR COMPLETE SYSTEMS IN ONE.

The CompuStar can be configured with any of four microprocessors — an 8086, an 80286, an 80386SX, or an 80386. The processor and up to *16* megabytes of user memory have all been combined, using the latest VLSI technology, on a single, plug-in CPU module. Plus, any time during the first year of ownership, CompuStar users can "trade-in" the CPU module they initially selected toward the purchase of any of the other more powerful modules. *Nobody* but Wells American gives you this kind of value.

CONVERTIBLE BUS? YOU'RE KIDDING!

No, we're not. In fact, it may well be the most practical microcomputer innovation ever. Say you've selected an AT compatible CompuStar and later want to add PS/2 compatibility. No problem! Snap in a PS/2 Bus and Adapter Module and you can use *both* buses in the same system. Likewise, if you've selected a PS/2 compatible CompuStar and decide you want to add an AT bus, just snap in an AT Bus Module. Depending on configuration, the CompuStar can have up to *13* bus expansion slots — all AT slots, all PS/2 slots or a "split-bus" of AT *and* PS/2 slots. Best of all, you can reconfigure your CompuStar whenever you want.

$1995

The CompuStar is also easily expanded. That's because there are *seven* CompuStar disk/tape compartments — six accessible from the front and an additional full-height bay inside. All this in a sleek, compact tower design that actually leaves *more* room on your desktop than any of the so-called "desktop" models.

A NEW IDEA FROM AN OLD COMPANY.

The CompuStar* Multi-Processor, Convertible Bus™ Microcomputer. It's no surprise that our engineers invented it. After all, we've been making microcomputers longer than anyone else. . .even longer than IBM! And if that kind of experience doesn't impress you, CompuStar's service programs surely will. You can select an optional overnight module swap-out plan or on-site service from General Electric Corporation — one of the most respected names in consumer electronics. And, of course, every CompuStar carries a full one-year factory warranty.

FINALLY, AFFORDABLE TECHNOLOGY.

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*Personal Computer AT, AT and PS/2 are trademarks of International Business Machines Corporation. †Photograph depicts optional equipment. Complete price list available upon request CompuStar 80286 base system ($1995) includes built-in VGA/EGA display adapter, one diskette drive with controller, two serial/one parallel/one mouse port, keyboard and 220 watt power supply.

CIRCLE 515 ON READER SERVICE CARD

Why you should care what a Big Eight accounting firm, a $12 billion bank holding company, PC Week, and Michel Guibord of Orleans, Ontario have to say about @BASE for 1-2-3.

You should care because they've discovered a not-so-obvious fact about database add-ins: When you put a real database into 1-2-3 you get capabilities that high-priced stand-alone database managers can't match.

And they discovered that one database add-in stands head-and-shoulders above the rest. @ BASE* is superior.

@BASE™ and 1-2-3® work together to solve business problems.

Coopers & Lybrand, a Big Eight accounting firm, was faced with a challenge. They needed to build a sophisticated tax application that could crunch lots of data and would also be easy to use.

"We started with 1-2-3 because it's very powerful and our clients already know how to use it. We turned to database add-ins for disk-based data storage and discovered that the capability of 1-2-3 is greatly magnified when access to data is unlimited."

C&L took a close look at @ BASE before designing it into their application. It performed well in all three areas deemed

Coopers & Lybrand chose @ BASE as the engine for this powerful tax application. @ BASE is also used in C&L's K-1 Partnership package.

*(pronounced "at base")

crucial to the success of their project. First, @ BASE was very fast in benchmark tests. Second, it was judged excellent for ease-of-use and ease-of-development. Third, it was found to be highly efficient in memory usage. C&L's conclusion: *"@BASE is a very good product. It really does the job".*

A $12 billion bank holding company chose @ BASE over other database add-ins for use throughout their banking system. Why?

"Our people are 1-2-3 users, not programmers. @BASE blends beautifully with 1-2-3, much better than the other products we looked at. @BASE is smaller and faster and our users pick up on it right away".

They also preferred @ BASE for its compatibility with dBASE III Plus. *"@BASE lets our 1-2-3 users get at data stored in dBASE files".* Some products can import and convert dBASE files but @ BASE is the only leading database add-in that reads and writes dBASE files directly.

Rave reviews.

You may not have time to perform your own evaluation. So check the reviews.

"The best of both worlds. @BASE is almost like having dBASE tamed and tailored for your worksheet". – PC World

"By far the most powerful dBASE-related add-in". – Personal Computing

"I could go on and on talking about the power of @BASE. Personics has changed the way 1-2-3 will be used from now on". – PCM

Fan mail.

Many @ BASE owners write comments on their registration cards. Here's what some of them had to say:

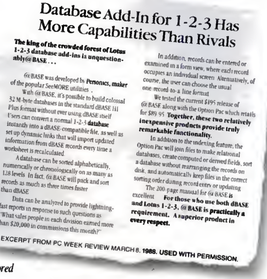
"@BASE is the best documented and easiest to use database add-in I've seen. Better than others we looked at. Clear, concise, complete". – Michel Guibord, Orleans, Ontario

"The best database I've ever used. Easy but still very powerful. Love it and thanks". – M. I., Fort Worth, TX

"Exactly what I need. Looks like someone has really done their homework". – J. Y., San Diego, CA

"Used @BASE at the office and I had to have it at home. Great job". – A. D., Lake Forest, IL

"Best Lotus add-in I've seen yet. Money well-spent". – J. P., Chicago, IL



Database Add-In for 1-2-3 Has More Capabilities Than Rivals

The king of the crowded forest of Lotus 1-2-3 database add-ins is unquestionably@ BASE . . .

@ BASE was developed by **Personics, maker** of the popular SeeMORE utilities . . .

With @ BASE, it's possible to build colossal 32 M-byte databases in the standard dBASE III Plus format without ever using dBASE itself. Users can convert a normal 1-2-3 **database** instantly into a dBASE-compatible file, as well as set up dynamic links that will import updated information from dBASE records every time a worksheet is recalculated.

A database can be sorted alphabetically, numerically or chronologically on as many as 128 levels. In fact, @ BASE will pack and sort records as much as three times faster than dBASE.

Data can be analyzed to provide lightning-fast reports in response to such questions as "What sales people in each division earned more than $20,000 in commissions this month?"

In addition, records can be entered or examined in a form view, where each record occupies an individual screen. Alternatively, of course, the user can choose the usual one-record-to-a-line format.

We tested the current $195 release of @ BASE along with the Option Pac which retails for $89.95. **Together, these two relatively inexpensive products provide truly remarkable functionality.**

In addition to the indexing feature, the Option Pac will join files to make relational databases, create computed or derived fields, sort a database without rearranging the records on disk, and automatically keep files in the correct sorting order during record entry or updating.

The 200-page manual for @ BASE is excellent . . . **For those who use both dBASE and Lotus 1-2-3, @ BASE is practically a requirement. A superior product in every respect.**

EXCERPT FROM PC WEEK REVIEW MARCH 8, 1988. USED WITH PERMISSION.

@ BASE is the best database add-in and also the smallest. A contradiction? Not really. It was developed by one of the Principal Engineers at Lotus behind 1-2-3 Release 2.

	@BASE	Silverado™	Oracle™ for 1-2-3	Informix™ Datasheet
Ease-of-Use	✓			
Ease-of-Development	✓			
Performance	✓			
dBASE Compatibility	✓			
Memory Conservation	✓			
Minimum Memory Requirement	78K	174K	250K plus 1MB Extended	300K

Growth path.

@ BASE is simple to use, compact and extremely powerful. And if you want to develop relational database applications, you can get the @ BASE Option Pac to add "join" capability and support for multiple indexes. In the future, as new releases of 1-2-3 and dBASE become available, compatible versions of @ BASE will follow.

We guarantee you'll like it.

We invite you to try @ BASE. If you don't like it for any reason you'll get your money back. @ BASE is available through leading software resellers and directly from Personics. Clip the coupon below or call toll-free. We also accept company purchase orders by mail or by fax. @ BASE works with 1-2-3 Release 2 on the IBM PC, XT, AT, PS/2 and compatibles.

@ BASE is from the makers of SeeMORE,™ SmartNotes,™ LOOK&LINK™ and UltraVision.™

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@BASE™ PC 10/88

I want to add database power to 1-2-3.
Please send me:
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____ copies of the Option Pac at $89.95 each.
Include $3.75 shipping per order. ($12 outside USA and Canada.) Mass. residents add 5% sales tax.

Payment: ☐ VISA ☐ MC ☐ AMEX ☐ DINERS ☐ CHECK

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CIRCLE 282 ON READER SERVICE CARD

The Cure for MacEnvy.

For years PC users have been conditioned to think of their computers in certain terms. Dependable. Versatile. Dull. To get superior graphics, some claimed that you need a different type of computer altogether. They said *their* computer was everything the PC wasn't. Easy to use. Graphically exciting. Fun. PC owners were, well, *green* with MacEnvy.

Enter Micrografx.

With the Micrografx family of applications, you don't have to trade in your PC. Micrografx software turns your computer into a complete graphics studio for desktop design, publishing, and presentations.

Allow us to illustrate.

Micrografx Designer lets you go from rough concept to finished art, giving you the power to bring your ideas to life. Micrografx Graph Plus™ is packed with easy-to-use charting features for the business user. Micrografx Draw™ gives you control and simplicity in a basic drawing program. And Micrografx software supports hundreds of printers like HP's LaserJet™ and PaintJet.™ All PostScript™ devices, too.

And there's more. Micrografx ClipArt™ libraries contain volumes of professionally designed symbols and illustrations. Micrografx Convert™ translates between the PIC and DXF file formats.

So take a bite out of the argument that PCs can't do superior graphics, and get the cure for MacEnvy. Ask your dealer for a demonstration or call us for more information.

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■ LETTERS

coprocessor with Weitek support. We have also redesigned the Cache Circuitry to increase the system's performance by 10 to 15 percent.

Edward Herko
Vice President
Herko Electronics Inc.
Spencerport, New York

Your review of the Proteus 386 A-20 ("20-MHz 386s: Hustle with Muscle") was informative, but you missed an important aspect of the Proteus product.

At Proteus, we believe that a product must include a strong warranty, support policy, and low price. Proteus has an outstanding warranty and return policy and was the first direct marketing PC company in the U.S. to provide on-site maintenance, even on a single quantity purchase.

Krish Shetty
President
Proteus Technology Corp.
Hasbrouck Heights, New Jersey

CHEAP SPEED

Thanks to Brian K. Roemmele's column on how to squeeze more speed from your memory (PC Lab Notes, *PC Magazine*, July 1988), I now feel like I have a turbo XT for less than $20!

Paul Ramos
Great Falls, Montana

IT'S IN THE BOOK

I would like to respond to Lynn A. Gerig's letter (Letters, *PC Magazine*, June 14, 1988) concerning the lack of the Apocrypha in the product *God Speed* (After Hours, *PC Magazine*, March 29, 1988).

The Catholic Church accepts the Apocrypha as "inspired by God" and includes them in its Bible. The Catholic Church used the Septuagint version of the Jewish scriptures as the basis for the Latin translation of the Bible. The Jews used the texts that we call the Apocrypha as the basis for two of their annual holy days: Purim and Hanukkah.

Therefore, it would seem to me that in the interest of completeness concordances should include the Apocrypha, even though users may ignore those references if they wish.

Kinter D. Bernard
Dale City, Virginia

UNIX VS. DVORAK

What is the basis for John C. Dvorak's tirade against Unix? More than once, he has written about the evils of Unix user interface and, at one point, even pronounced it dead ("The Big Lie," *PC Magazine*, March 29, 1988). In his space-filler in the August issue, he described it as "a hard-to-use techie-nerd OS" ("The Ugly Reality: Unix Is in Your Future," *PC Magazine*, August 1988).

Any Unix deficiency is seen in greater splendor in DOS. The assortment of utility programs provided with each system all favor the rich Unix versions over the pale DOS imitations. To me, Unix is a far superior operating system, with a consistent set of system-level commands.

■ It's amazing that such a superior operating system as Unix has sold fewer copies than Digital Research's Concurrent DOS.

If Mr. Dvorak wants to continue his vendetta, I think he should use some comparative facts in his arguments.

Gary Perlman
Ohio State University
Columbus, Ohio

Golly, with all this boosterism it's a miracle that anyone bothers to use MS-DOS at all. It's amazing that such a superior operating system as Unix has sold fewer copies than Digital Research's Concurrent DOS. I hope someday there is an explanation for this curious phenomenon.
—John C. Dvorak

HOW TO WRITE TO PC MAGAZINE

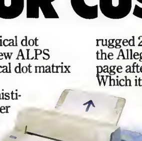
Send letters to *PC Magazine*, One Park Avenue, New York, NY 10016, or upload to PC MagNet. All letters become the property of *PC Magazine* and are subject to editing.

THIS IS WHAT HAP
LET OUR CUSTOMERS

This is not exactly your typical dot matrix printer. But then, the new ALPS Allegro 24 wasn't built in typical dot matrix printer fashion.

It's the result of a highly sophisticated new design process, never before attempted by any other printer company. We call it "Giving the Customers What They Want."

You told us you wanted a rugged 24-pin printer for under $500. Which the Allegro 24 is. You wanted it to churn out page after page of crisp, letter-quality output. Which it does. And you wanted it with easy-to-use front panel controls. Which, of course, it has.



Then you insisted that it be jam-proof. Which explains this printer's uncharacteristic profile. You see, it has no platen. Just a unique flatbed design for a

PENED WHEN WE DESIGN A PRINTER.

paper path that's straight, direct and virtually unjammable.

As if that weren't enough, you asked for—and got—features like "paper parking," for automatic switching from fan-fold to single sheet feed. Four resident type fonts. And full compatibility with most all the PCs and software you already have.

For a free demonstration of the printer you've always wanted, see your local ALPS dealer. Or direct your questions, comments and brilliant ideas to us at 800-828-ALPS. In California, 800-257-7872.

And help us design our next printer.

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CIRCLE 242 ON READER SERVICE CARD

What turns four useless, disconnected monochrome monitors and keyboards into four speedy, graphic workstations

for about the cost of an executive desk?

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VNA comes complete with the hardware, PC-MOS operating system, cabling, and easy-to-follow instructions for a quick installation. And like everything else from The Software Link, your satisfaction with the VNA is guaranteed, or your money back.

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Data Equipment/Communications Carrollton, TX 214/960-2585 • **L. K. H., Inc.** Los Angeles, CA 805/268-1256 • **Information Engineers** Scotts Valley, CA 408/438-3339
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CIRCLE 393 ON READER SERVICE CARD

Q&A Write

PFS: Professional Write

PC MAGAZINE

Editor's Choice, 1988

"Superpowerful, supereasy, superfast, Q&A Write is superessential if you need a professional word processor that doesn't require hiring a personal trainer. It has all the answers."
Carol Olsen Day/PC Magazine, 2/88

INFO WORLD

"The Best" Executive Word Processor, 1987

"Between Q&A Write and PFS: Professional Write, we prefer Q&A Write..."
John Lombardi/InfoWorld, 10/87

EASY-TO-USE WORD PROCESSOR CHECKLIST.

On February 29, 1988 *PC Magazine* published the most comprehensive word processing comparisons ever undertaken. Q&A Write was rated higher than PFS: Professional Write... it earned an *Editor's Choice*. On October 12, 1987, *InfoWorld* magazine evaluated seven "Executive Word Processors" including PFS: Professional Write. Q&A Write was again "The Best." And in July 1988, in a similar review, Q&A Write was given the highest rating by *Software Digest* for "Simplified Word Processing Programs."

In review after review, comparison after comparison, Q&A Write continues to amaze the critics with its unique combination of power, flexibility, and ease of use. And now with a simple phone call, you can review it for yourself.

Call us today, toll-free and we'll send you an unbiased, "Expert Testimony" package including highlights of the *PC Magazine* and *InfoWorld* articles, reviewers' quotes, and actual user testimony. And as a bonus to the first 10,000 callers, we'll send something even better: a complete, working trial version (regularly $9.95)—free. PFS: Professional Write or Q&A Write? With expert testimony, an easy-to-use checklist, and the real McCoy to try on your computer, the "write" decision is #1. Q&A Write.

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The #1 Executive Word Processor

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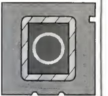
■ **JOE DESPOSITO**

PC ADVISOR



Help in writing batch files that can issue commands within a program, how to run color/graphics software with a monochrome graphics card, and checking your writing style.

BATCH FILE AND MONO BLUES

Is there any way to automate the process of answering questions when you start up a program? Sometimes a Y or N is required; other times it's just pressing Enter. Is there any way to have this as part of a batch file? I've tried using the hex equivalent of a carriage return with no luck. Would I need to write a .COM or .EXE program to do something like this?

Also, what's the matter with programmers? Do they assume that everyone has a color monitor? I have a monochrome monitor at home, and of the PC-XTs and ATs at the office (nearly a dozen), only three have color monitors. There are many programs I'd like to have, but I can never even get them out of the store once I read "CGA Graphics Required." I shouldn't have to buy an adapter board to get around this; it should be part of the program. Any comments?

George Zema
Danville, California

One of the PC Magazine *utilities,* Key-Fake, *is designed for use with batch files that call up application programs. It supplies the series of keystrokes needed to initialize the program. For example, you could use* Key-Fake *to enter* Lotus 1-2-3 *and set it for File Retrieve. It will take you past the necessary initial carriage returns and /FR command without your having to enter them in each time.*

Key-Fake, *which is a memory-resident program, does have problems with programs such as* XyWrite II *that get keyboard information directly from the hardware keyboard interrupt. Also, it doesn't work well when you are on-line using a communications program.*

The keystroke sequence stored in Key-Fake *is limited to 124 characters and must be on one continuous command line. Keystrokes not supported by the PC BIOS (for example, Alt-Home) cannot be stored.*

Key-Fake *and all other* PC Magazine *utilities can be found on PC MagNet. A detailed explanation of PC MagNet and how to join can be found in the May 31, 1988, issue of* PC Magazine *(page 46).*

If you get the urge to automate your computing even more, you might consider trying a new product on the market called Beyond.Bat *from Relay Communications (41 Kenosia Ave., Danbury, CT 06810; (203) 798-3800). It makes smart batch programs possible with a tool kit from the Relay (a communications product) script language. You could use it, for example, to pull up a name from a database and automatically move the information into a word processing document. The suggested retail price of* Beyond.Bat *is $99.*

■ If you have a Hercules or compatible monochrome adapter, you can buy software that runs color/graphics programs on monochrome systems.

Another alternative is EBL, *a shareware program from Seaware Corp. (P.O. Box 1656, Delray Beach, FL 33444; (407) 392-2046). The initials stand for Extended Batch Language. The program uses a BASIC-like syntax and, as one feature, can automatically issue keystrokes to an application program just after it loads. The shareware registration cost is $49.*

As for your question about programmers—I don't know why they write programs that require a color/graphics adapter. However, I do know how to get around the problem: if you have a Hercules or compatible monochrome adapter, you can purchase software that will let you run color/graphics programs with your monochrome system. One of the best is Softgraf *from the Sunrise-Littleton Co. (15200 Shady Grove Rd., #350, Rockville, MD 20850; (301) 762-8463). It shows colors as shades of amber or green, runs most self-booting programs, is memory resident, and uses less than 12K RAM. The suggested retail price of* Softgraf *is $34.95.*

Another program is Do-Color *from Wilkinson Software (6400 Westminster Blvd., #115, Westminster, CA 92683; (714) 894-3216). It sells for $29.95.*

AIN'T IT GRAMMATICAL

I would like any information you have concerning software that is capable of reviewing writing style, grammatical errors,

■ PC ADVISOR

and language usage. I have recently seen fliers on two programs that claim such capabilities. One program, *Grammatik II*, is by Reference Software; the other is *RightWriter*, by RightSoft. Do these programs work with common word-processing programs such as *WordStar* and *WordPerfect*, which already have the advantage of spelling correction and a thesaurus?

Rex Harman
Norton, Kansas

Five style checkers, including the two you mention, were reviewed in "The Quest for Style" (PC Magazine, *May 27, 1986). All handled document analysis in a slightly different manner. Remember, treat a style checker like a good friend rather than a police officer. Let it make the suggestions, but you make the final decisions.*

Grammatik II *(Reference Software, 330 Townsend, #123, San Francisco, CA 94107; (800) 872-9933 or (415) 541-0222) is modeled after the Unix-based* Writer's Workbench. *It compares a word-processed document with its large-phrase dictionary, then creates marked up copy for you to correct with your word processor. Suggested retail price is $89.*

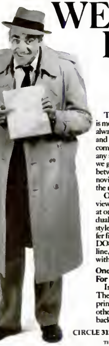
■ Treat a style checker like a friend rather than a police officer. Let it make suggestions, but you make the final decisions.

RightWriter *(RightSoft Inc., 2033 Wood St., #218, Sarasota, FL 33577; (800) 992-0244 or (813) 952-9211) works in a manner similar to that of* Grammatik II. *It compares a word-processed document with a combination of grammar/syntax rules and a phrase dictionary.* RightWriter*'s cost is $95.*

Of the others, Punctuation and Style *(Oasis Systems, 6160 Lusk Blvd., Suite C-206, San Diego, CA 92103; (619) 453-5711) has the most to offer. Besides a phrase utility to deal with style, it also has a cleanup utility to deal with punctuation. Its suggested retail price is $125.*

Yes, these products will work with the more popular word processing programs on the market.

ASK THE ADVISOR
Send your questions to PC Advisor, *PC Magazine*, One Park Avenue, New York, NY 10016. Please specify your equipment.



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No matter how it's protected, be sure you can back it up. **For the dealer nearest you, or to order direct, call (503) 690-8090,** M-F, 8 a.m. to 5 p.m. (West Coast time).

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CIRCLE 160 ON READER SERVICE CARD

Searching For The Right Word Processor? Ask Samna Your Toughest Questions.

No matter what business you're in, chances are your company produces more words than anything else. So the crucial decision for a company-wide or department-wide word processor boils down to four tough questions:

1. Does the system have the advanced features and the ease of use to satisfy *all* user groups—including secretaries, documentation writers, managers, engineers and the legal staff?
2. Is the learning curve a gentle slope—or a brick wall?
3. Is the system truly a *corporate* word processor, capable of supporting single users and multi-user networks in both DOS and UNIX environments (including SCO XENIX)?
4. Will you be in direct and continuing contact with the vendor's sales and support people, even if you buy the product from a local dealer?

When The Questions Are Tough, The Decision Is Easy.

Evaluate word processors like the big companies do: Ask those four questions, plus all your other key criteria. You'll see why the clear choice is Samna—at companies like AT&T, General Motors, Liberty Mutual, Anheuser-Busch and Chemical Bank. At government agencies like NASA, the Secret Service, the U.S. Army, the U.S. Air Force, the Executive Office of the President and United Nations International. At institutes of higher learning, such as the University of Texas and the University of Colorado. And at businesses of all sizes, including health organizations and law firms.

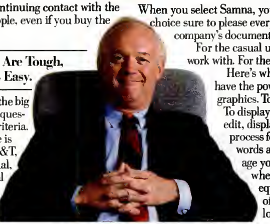
These organizations wanted to look good on paper. So their evaluators took a long, hard-nosed look at Samna. They found an unrivaled combination of power, productivity, versatility and ease of use. And they found outstanding field support, tailored for a corporate clientele.

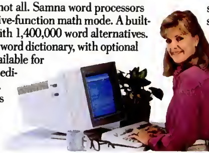
Corporate-Class Word Processing.

When you select Samna, you've made an impeccable choice sure to please everyone who produces the company's documents—from memos to manuals.

For the casual user, Samna is a pleasure to work with. For the "power" user, it's sheer bliss.

Here's why. Samna word processors have the power to integrate text with graphics. To preview the printed page. To display two documents at once. To edit, display and move columns. To process forms, merge files, hyphenate words and mark revisions. To manage your printers, fonts and printwheels. To type, edit and display equations. And to find dozens of short cuts for producing long documents.





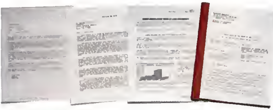
But that's not all. Samna word processors also include a five-function math mode. A built-in thesaurus with 1,400,000 word alternatives. And an 80,000-word dictionary, with optional dictionaries available for the legal and medical professions.

Samna Plus IV, our top-of-the-line product available for both DOS and UNIX users, offers even more: A built-in, full-text retrieval system and a built-in spreadsheet system. If you need an outstanding business graphics system, Samna Decision Graphics is a powerful option.

Samna Speaks DOS And UNIX.

If your organization has a mix of DOS, UNIX, single users, multi-user systems and shared-resource networks, you need Samna.

Because Samna is the first full-featured word processor available for DOS *and* most UNIX environments and models, including SCO XENIX, AT&T, NCR Tower, UNISYS, IBM RT/PC, Convergent Technologies and 386 UNIX systems. So now, for the first time, UNIX users can enjoy the same high-end features so popular with DOS users. In fact, anyone trained on Samna can easily switch between the UNIX and DOS products, with identical files and command keystrokes.



Samna combines easy-going friendliness with a huge arsenal of features. Whether you're facing a short memo...a report with integrated graphics...a legal document...Samna has all the word processing power you'll ever need.

Both products give you the ability to retrieve any text from any file—anywhere on the disk. And both are rich with desktop publishing features. Such as flawless integration of your words with scanned pictures, charts, graphs and symbols...display and printing of up to 10 side-by-side columns...and sophisticated print functions to get your words and images on paper quickly and beautifully.

How To Find Nuggets Of Information.

Finding information can be just as important as writing new documents. Particularly in a multi-person network. But how can you uncover *all* references to a topic scattered among many documents? How can you find something misfiled or "lost" on a large system when you can't determine the document's title, directory, file name or date written?

The answer is WordBaseManager, the full-text retrieval system built into Samna Plus IV. Whatever the subject matter—a name, a phrase, a date, a reference number, anything—you can find all occurrences in mere seconds. Then review each reference, editing as you go.

Suddenly, a disk full of files becomes a research library. You'll find dozens of nifty uses. Examples: To compile a report from diverse sources. To purge outdated files. To search personnel files for specific qualifications. To unearth favorite phrases in past letters. To find obscure facts buried in reams of legal depositions. In short, to find the proverbial "needle in a haystack."

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In any organization, turnover is a costly fact of life. As you know, the cost is magnified if new employees must learn a cumbersome word processor with hundreds of cryptic commands to memorize.

Samna helps the new user make a smooth, comfortable transition to full productivity. With a learning curve that's mercifully short. And gentle, too.

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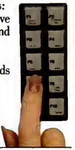

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- 30 MHz Throughput Performance
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- Upright Tower Chassis (Desktop chassis is optional)
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- Clock w/Battery Backup
- 80287 & 80387 Math Co-Processor Support
- Complete Users Manual & Technical Reference Manual
- Built-in Setup & Diagnostics Program

Austin 386-20	Monitor and Adapter Cards Included		
	EGA 640 × 350	VGA + 640 × 480	VGA DELUXE 600 × 800
40 MB 30 mls 1:1	$3795	$4095	$4195
80 MB 28 mls 1:1	$4095	$4395	$4495
158 MB 18 mls ESDI	$5595	$5595	$5695
322 MB 18 mls 1:1	$6995	$6995	$7095

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- True Intel 12.5 MHz 80286 Processor
- 1 MB of RAM (Exp. to 4 MB on Board)
- 1-Year On-Site GE Computer Service Support
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- Shadow RAM buffers slow BIOS calls into Fast RAM
- American-Made MotherBoard
- 3.5″ 1.44 MB or 5¼″ 1.2 MB Floppy Disk Drives
- Phoenix BIOS
- Keytronics Enhanced 101 Keyboard
- 2 Serial Ports & 1 Parallel Port
- 1 PS/2 Mouse Port
- Clock w/Battery Backup
- 80287 Math Co-Processor Socket
- FCC Class B Approved
- Complete Users Manual and Technical Reference Manual
- Complete Diagnostic & Utility Software

Austin 286-12.5	Monitor and Adapter Cards Included		
	EGA 640 × 350	VGA + 640 × 480	VGA DELUXE 800 × 600
20 MB 30 mls 1:1	$2195	$2395	$2595
40 MB 30 mls 1:1	$2295	$2595	$2795
80 MB 28 mls 1:1	$2595	$2895	$2995
130 MB 25 mls 1:1	$3295	$3995	$3795

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PC MAGAZINE FIRST LOOKS

OS/2 Extended Edition: Lackluster Preview of IBM's Future Standards

PC HANDS ON

BY CHARLES PETZOLD

A normal operating system has something for programmers and something for users. For the programmer, the operating system's API (application program interface) allows programs access to all the services that the operating system provides (such as file I/O and memory management). For the user, an operating system also includes a collection of programs (such as CHKDSK and TREE) that themselves take advantage of this API.

IBM's OS/2 Extended Edition 1.0 is a normal operating system—only more so.

While OS/2 Standard Edition includes only small simple utilities such as CHKDSK and TREE, Extended Edition adds two heavyweights—Database Manager and Communications Manager. Database Manager is a full-fledged relational database management program based on IBM's Structured Query Language (SQL, pronounced "sequel"), and Communications Manager is an all-purpose 3270 emulation and RS-232 communications program.

Of course, because Database Manager and Communications Manager run under OS/2, they can run at the same time. If you're so inclined, you can indeed sort a database table while downloading from an on-line service and running multiple 3270 sessions.

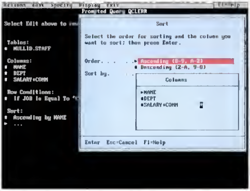
But what is this? Are these two programs really part of an operating system? Or is OS/2 Extended Edition just an attempt by IBM to bundle a couple of large programs with OS/2?

A little of both, perhaps. OS/2 Extended Edition qualifies as an operating system because it also provides an extended API for database and communications support. This API is used by the Database Manager and Communications Manager programs, but it is also available for use by programs from other software manufacturers.

The extensions to OS/2 that are included in OS/2 Extended Edition were developed by IBM outside of the IBM/Microsoft Joint Development Agreement (under which OS/2 Standard Edition and the Presentation Manager were developed). Hence, OS/2 Extended Edition will be available from only IBM Corp. for use on IBM hardware.

OS/2 Extended Edition runs on all IBM 80286- and 80386-based personal computers, including the IBM PC AT, XT Model 286, and PS/2 Models 50

(continues on page 36)



```
Prompted Query QCLERR

Select Edit above to

 Tables:
•  NULLID.STAFF

 Columns:
•  NAME
•  DEPT
•  SALARY+COMM

 Row Conditions:
•  If JOB Is Equal To '

 Sort:
•  Ascending by NAME
►  ...

                          Sort

Select the order for sorting and the column you
want to sort; then press Enter.

Order. . .    . .► Ascending (0-9, A-Z)
                 • Descending (Z-A, 9-0)
Sort by.      . .
                        Columns
                  ►NAME
                  •DEPT
                  •SALARY+COMM

Enter  Esc=Cancel  F1=Help
```

OS/2 EE's Database Manager lets you use menus to build and access databases. It generates and displays SQL code that corresponds to your menu choices.

Compaq's Smaller, Faster Deskpro

PC HANDS ON

BY GUS VENDITTO

Think IBM's PS/2 Model 70 is one slick piece of work? You ain't seen nothin' yet. Compaq does not lightly suffer challenges to its leadership position in building state-of-the-art 386 PCs, and the Compaq Deskpro 386/20e is a firm reminder.

The Compaq Deskpro 386/20e is the fastest 20-MHz PC you can buy and among the smallest. It equals the performance of the full-sized Deskpro 386/20 in every area but two, where it shows strong gains.

Compaq engineers matched all the major design specs of the 386/20 while shaving space from the system board. There's a 32K static RAM cache; two separate 32-bit RAM sockets (one accepting full-sized plug-in cards, the other holding small SIMM modules lying flat on the motherboard); sockets for an Intel 387 or Weitek 3167 coprocessor; and the fastest VGA

(continues on page 35)

HANDS-ON INDEX

Opus: Hyperdrawing Package Links Graphics To Database Records and Other Drawings

HANDS ON

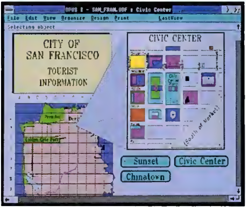
BY DONALD B. TRIVETTE

We live in the video age, conditioned to respond to logos and symbols of all types. It's not surprising, then, that someone would develop a graphical database that links drawings and symbols with statistics and data. Roykor Software's *Opus I* is just such an animal.

Opus I, which runs under *Microsoft Windows*, allows drawings to be linked to numerical data and tables and to other drawings. Roykor calls this a "hyperdrawing" capability.

The program comes with a tutorial and several demonstrations to showcase *Opus I*'s capabilities; my favorite displays a colorful map of the United States. By clicking on any state, you can bring up population, geographical, or statistical tables about that state. Click New York and learn that the state flower is the rose, the state tree the sugar maple, and the nickname the Empire State.

Using the features of a conventional database program, *Opus I* can perform calculations, filter data, and print tables. Using the Draw command you can design and create a button on the screen—round, square, or state-shaped—and then select features from menus to define what the button will do. The map of states, for instance, has a button for states that entered the union before 1860. Click it with the mouse, and the screen redraws the map to show only states meeting that criterion.



Opus I's hyperdrawing features allow you to link sections of drawings or buttons that you define to text or other drawings.

Creating an application is like creating a conventional database *and* preparing a set of drawings with a paint program. First you create or import the drawings. Next you design the fields for the database and possibly create forms for entering data. The third step is to enter or import the actual data. Then you can assign and relate the drawings to the records. Finally, you define buttons to recall and present the data in specific ways.

Opus I is menu driven and is equipped with help screens and a good manual to provide guidance in creating applications. Nevertheless, it takes time and patience to pull the parts of a database together.

If either your artistic abilities or your time is limited, you'll want to import drawings. The *Windows* clipboard can be used for that. Currently *Opus I* imports any bit-mapped image—like those produced by *PC Paintbrush*—from the clipboard; it can also import graphics with the .OBJ format from Micrografx programs like *PC-Draw* and *Designer*. Since most scanners can place output on the *Windows* clipboard, those drawings are available to *Opus I* as well. Roykor plans to add direct video and .TIF formats to the next version. The software can export in several formats, including one directly compatible with *PageMaker*.

Part database and part paint program, *Opus I* is neither. It has the features of a flat-file database and thus lacks relational capabilities. Although applications are limited to 10,000 records and 100 fields, a utility lets you save drawings to separate files so they may be used in several applications. Once you create a map of the United States, for example, you can use it in any application by including its filename.

Opus I lacks some of the more sophisticated features found in high-end paint programs for shading and coloring. On the other hand, it was not meant as a replacement for either database or paint programs.

Opus I takes time to master, and developing applications requires a good bit of thought and graphics mastery. Still, for anyone willing to invest the time and effort, the program provides a unique tool for presenting information in a colorful, engaging format.

FACT FILE

Opus I
Roykor Software Inc.
749 Brunswick St.
San Francisco, CA 94112
(800) 227-0847
List Price: $395
Requires: 512K RAM, graphic display, mouse recommended (runtime *Microsoft Windows* included with software).
In Short: A graphical database that can link multiple drawings with tables and statistics. Not copy protected.

CIRCLE 481 ON READER SERVICE CARD

Panasonic Debuts Low-Cost 24-Pin Dot Matrix Printer

PREVIEW

BY JONATHAN MATZKIN

As this issue was going to press, Panasonic's latest value-packed printer rolled into PC Labs. The Panasonic KX-P1124 is about to do for 24-pin dot matrix printers what the KX-P1091i did for 9-pin units.

The $529.95 printer comes with five internal letter-quality fonts and accepts fanfold paper from the front, rear, and bottom panels. Paper parking allows easy insertion of cut sheets, and the KX-P1124 handles business envelopes as well. The 11.7-inch carriage allows 8½- by 11-inch cut sheets to be printed in either portrait or landscape orientation.

Virtually all of the KX-P1124's features are accessible from a flat-membrane control panel on the front of the printer. The control panel gives such complete access to features, in fact, that Panasonic has completely done away with DIP switches. Three print settings can be stored in nonvolatile memory and recalled at the touch of a button.

Look for a full hands-on review in these pages in the next issue of *PC Magazine*.

Deskpro 386/20e

(continued from page 33)

around. All this squeezes into the same chassis that houses Compaq's 386S, saving 93 square inches.

The result is a machine with a display that pops into action faster than any other 20-MHz PC. That's because Compaq fully integrated the VGA circuitry onto the motherboard, and then tweaked it a little more to achieve the first all-Compaq VGA BIOS yet. Compaq says its chip set is fully compatible with IBM's VGA hardware registers, and PC Labs tests found no incompatibilities.

Integration also works wonders for this machine's hard disk, the same Connor Peripherals 3½-inch disk, with its own integrated controller, used on the Deskpro 386S. The disk is offered here in 40MB and 110MB sizes. The disk/controller combination shoots data into the system far faster than the 16-bit ESDI controller on the Deskpro 386/20, even though this disk's raw access time is about 5 milliseconds slower.

This is a machine that borrows heavily from the new Deskpro 386S. The same 15¾-inch-wide cream-colored box houses the same I/O configuration: bays for two 3½-inch hard disks and three floppy disk or tape drives. Serial, parallel, keyboard, and mouse ports are integrated on the motherboard, as is a floppy/tape controller, leaving one 32-bit memory expansion slot and four 16-bit slots free for options.

The Compaq Deskpro 386/20e's chassis replicates the trim Deskpro 386S design and has its VGA circuitry fully integrated onto the system board. These design elements yield a small-footprint machine that is the fastest 20-MHz PC available.

All of this engineering bravado took real smarts, but Compaq's marketing stance on the machine shows it also has a healthy supply of guts. To make room for the 386/20e in the product catalog, Compaq will retire the Deskpro 386 (a 16-MHz computer) and the Deskpro 386/20, two of the most popular PCs ever made.

And how does the 386/20e compare with the IBM PS/2 Model 70? IBM's looks smaller, thanks to a narrower front, but the Model 70 is deeper than the Deskpro 386/20e. They occupy exactly the same amount of real estate.

You have a choice of three Model 70s (a 16-, 20-, or 25-MHz machine) but right now only one true small-footprint 386 from Compaq.

Your expansion options are greater with the 386/20e: you have one more slot (not counting the proprietary memory slots), and it's an AT-style slot, not MCA. If you're lucky enough to install 16MB of RAM, you'll still have four slots in the 386/20e, but you'll be down to two in the Model 70 (the 20-MHz model accepts up to 6MB only on the system board). And, finally, the 386/20e will fit up to five drives while the Model 70 will accommodate only three.

You'll have to be a strong believer in the Micro Channel architecture to prefer the Model 70 over this latest wonder from Compaq.

PC MAGAZINE FACT FILE

Compaq Deskpro 386/20e
Compaq Computer Corp.
2055 FM 149
Houston, TX 77070
(800) 231-0900

List Price: $5,299 with one floppy disk drive; $6,499 with 40MB hard disk; $7,999 with 110MB hard disk.

In Short: More performance than the Deskpro 386/20 in a smaller box.

CIRCLE **449** ON READER SERVICE CARD

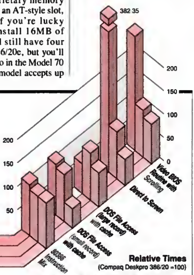
Benchmark Tests: Compaq Deskpro 386/20e vs. Compaq Deskpro 386/20 vs. IBM PS/2 Model 80-111

PC LABS

Integration of components is the key to the Compaq Deskpro 386/20e's lightning speed in the VGA tests and its besting of the original Deskpro 386/20's hard disk throughput performance. In tests of every other component, however, the Deskpro 386/20e matched the numbers posted by its predecessor. The IBM 20-MHz PS/2 Model 80-111 shines only in disk throughput when taking advantage of a disk cache with large records.

Performance Times
(Times given in seconds)

	80386 Instruction Mix	**DOS File Access (small record)** with cache	**DOS File Access** (large record) with cache	**Direct** to Screen	**Video BIOS Routine with** Scrolling
IBM PS/2 Model 80-111	3.20	36.79	6.11	6.50	3.50
Compaq Deskpro 386/20	2.91	34.22	9.64	1.70	1.43
Compaq Deskpro 386/20e	2.91	14.32	6.97	0.94	1.21



Relative Times
(Compaq Deskpro 386/20 =100)

The **80386 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the total processor instruction set.

The **DOS File Access** benchmark test measures the throughput rate of the disk being tested. In this case, throughput times are measured in terms of how long the disk takes to perform common DOS file-management functions. Five tasks—file creation, sequential file write, sequential file read, random file write, and random file read—are timed and the results summed.

The test is carried out for two different types of files—small-record files and large-record files—that are used by common PC applications. Files created using small records are typically used by database management programs, and large records are typically used for word processing and spreadsheet files. Loading a DOS program is also simulated by the large-record test.

The **Direct to Screen** benchmark test measures the bandwidth of the video adapter by writing directly to the display memory buffer. The test is performed in video mode 3. The entire screen is updated using the assembly language REP STOSW instruction with register CX equal to 2000. This is done 1,000 times.

The **Video BIOS Routine with Scrolling** benchmark test measures the speed of the BIOS Teletype routine with scrolling. The test is performed in video mode 3. The screen is cleared and 240 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. Although the first 24 lines written to the display do not involve scrolling, all the remaining lines scroll the display.

OS/2 EE 1.0

(continued from page 33)

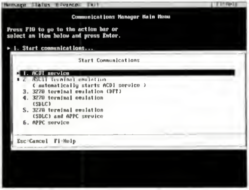
and above. Extended Edition does not make any special use of the PS/2's Micro Channel architecture.

The Database Manager and Communications Manager currently run in character mode in full-screen OS/2 sessions. In November 1988, IBM is scheduled to release OS/2 Extended Edition 1.1 as a free update to Version 1.0. Version 1.1 will include local area network support and the Presentation Manager, the graphics-based windowing environment that is part of OS/2 Standard Edition 1.1. However, the Database Manager and Communications Manager will not immediately be converted to the Presentation Manager environment and will continue to run in character mode.

The Database Manager is the most impressive part of OS/2 Extended Edition—and it should be. After all, IBM invented the relational database and developed the Structured Query Language.

You don't have to know SQL to use the Database Manager. Like most modern database management programs, it's almost entirely menu driven. An extensive tutorial in the User guide takes you through the procedures for defining tables, entering data, creating queries and reports, and defining your own menus and fill-in panels. If you want, you can use SQL directly for some of the tasks. Or you can look at the SQL code generated from your query and report specifications.

Most of the Database Manager functions are easy to use, and context-sensitive help is available at any time. Perhaps the most significant weakness is the import facility, which is limited to delimited ASCII and *Lotus 1-2-3* and *Symphony* files.



```
Message  Status  Advance  Exit                              F1=Help

                  Communications Manager Main Menu

Press F10 to go to the action bar or
select an item below and press Enter.

► 1. Start communications...
   ┌──────────────────────────────────────────────────────────┐
   │               Start Communications                       │
   │                                                          │
   │► 1. ACDI service                                         │
   │• 2. ASCII terminal emulation                             │
   │     ( automatically starts ACDI service )                │
   │  3. 3270 terminal emulation (DFT)                        │
   │  4. 3270 terminal emulation                              │
   │     (SDLC)                                               │
   │  5. 3270 terminal emulation                              │
   │     (SDLC) and APPC service                              │
   │  6. APPC service                                         │
   │                                                          │
   │ Esc=Cancel  F1=Help                                      │
   └──────────────────────────────────────────────────────────┘
```

The Communications Manager provides plenty of terminal emulations, but you will find no script facility and only minimal file-transfer protocol support.

OS/2 Extended Edition also includes a utility that lets you embed SQL statements in a C program; the utility converts the embedded SQL to C so the program can be compiled normally. Like the database API, this utility is documented in other IBM publications rather than the manuals shipped with OS/2 Extended Edition.

The Communications Manager supports asynchronous communications with VT100 or 3101 emulation through an RS-232 port, and 3270 emulation using IBM's Advanced 3278/79 Emulator Adapter (for the PC AT or the XT Model 286) or the 3270 Connection Adapter (for PS/2s). The LAN workstation support that will be added to OS/2 Extended Edition 1.1 will also be a part of the Communications Manager.

The Communications Manager combines asynchronous and 3270 communications in one program. Otherwise, it's a real dog—unbearably slow, hopelessly confusing, and lacking many important features.

For example, there is no script facility. Particularly for a multitasking environment like OS/2, scripts are essential for background communications. There is not even an automated log-on facility. The best you can do is specify your log-on sequence as a "call continuation string" that is sent after connection, but this is not driven by prompts, so it doesn't always work right.

The only non-ASCII file-transfer protocol for asynchronous communications is Xmodem, which is quickly losing ground to other file-transfer protocols. I tried using Communications Manager's Xmodem to download a couple of files from PC MagNet. Sometimes it worked. Sometimes it didn't.

Superficially, OS/2 Extended Edition equals OS/2 Standard Edition plus Database Manager plus Communications Manager. In this sense, OS/2 Extended Edition is nothing more than a couple of large programs bundled with an operating system.

But in the long term, the real value of OS/2 Extended Edition is its API. This API allows other software manufacturers to write programs that use Extended Edition's database and communications facilities.

This is clearly to IBM's advantage—these applications will require OS/2 Extended Edition to run, and Extended Edition is sold only by IBM for use on IBM personal computers.

For software manufacturers, there are advantages and disadvantages: program development time is reduced (because IBM has already done a lot of the development work), but the market is limited to IBM machines running OS/2 Extended Edition. The fate of Extended Edition is likely to be an interesting sideshow in the saga of OS/2. ■

A Disappointing SAA Debut

OS/2 Extended Edition is the first IBM product for the PC that demonstrates a large implementation of user interface standards known as Common User Access (CUA), which is part of Systems Application Architecture (SAA). SAA is IBM's ambitious plan to standardize APIs, user interfaces, and languages across their entire line of computers.

While the Communications Manager may follow the letter of CUA guidelines, it certainly does not follow the spirit. CUA is supposed to make programs more intuitive and easier to learn. But the command structure of Communications Manager (and, to a lesser extent, Database Manager) is so convoluted and confusing that after several days I was still being surprised by the screens that would appear after selecting menu options.

If I didn't know any better, I'd say that CUA was a complete and total failure. But fortunately, other software manufacturers have recently been designing programs with a CUA-style interface. The problem is obviously not with CUA but with the OS/2 Extended Edition implementation.

—Charles Petzold

PC FACT FILE

OS/2 Extended Edition 1.0
IBM Corp.
Contact your local authorized IBM dealer.
List Price: $830 ($675 as upgrade from OS/2 Standard Edition)
Requires: IBM PC AT; XT Model 286; PS/2 Model 50, 60, 70, or 80; 3MB memory; 20MB hard disk space.
In Short: IBM's latest version of OS/2 includes Database Manager and Communications Manager, two programs that extend the functionality of OS/2. Database Manager is strong, but Communications Manager is weak. Both suffer from user-interface problems. Not copy protected.

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CIRCLE 299 ON READER SERVICE CARD

Zortech Ships First C++ Compiler; Includes ANSI C Compiler and Proprietary Graphics

HANDS ON

BY STEPHEN RANDY DAVIS

C++, with its object-oriented concepts such as function overloading and class inheritance, is becoming an important language. Unfortunately, until now C++ compilers were actually translators, taking C++ source code as input and generating C source code as output. This C code must then be run through a standard C compiler to generate the actual machine instructions.

There are several problems with the translator approach. First of all, the translation step is often clumsy and time-consuming. In addition, it can be difficult to trace an error message in the actual compile of the C source code back to the problem in the C++ code. Finally, source code debuggers want to work at the C level, not at the level of C++.

This makes all the more noteworthy the announcement of the first true C++ compiler for the PC. When I first saw Zortech C++, I admit to having nightmares of a C++ translator somehow grafted as a first pass onto a conventional C compiler. Fortunately, this is not the case.

Zortech C++ is in its relative infancy, as is C++ itself. However, the problems I encountered with this package were minor, and Zortech has committed itself to following the evolving AT&T C++ standard in detail.

Included on Zortech C++'s ten 360K disks are both an ANSI C and a C++ compiler, along with a shell program to automatically execute their multiple passes.

Source Code Editor

Zortech C++ also includes a source code editor called ZED. Although ZED has its own commands, it understands the familiar *WordStar* command set as well, so most users can begin using it immediately. ZED adds sophisticated features such as on-line help, multiple-level undelete, multiple-file editing, and the ability to execute the compiler from within the editor.

If an error is found, ZED displays a message at the top of the screen and places the cursor on the problem. A TSR help program allows the user to pull up small help notes on most aspects of C and C++.

Overall, the feel is not quite as slick as with fully integrated compiler/editors, but it's still very good.

Along with its ANSI-compatible library, Zortech C++ includes a proprietary graphics package, *Flash Graphics*. Both are documented in Zortech's 560-page manual, which includes sample programs. The source code for the library, but not *Flash Graphics*, is available as an option.

Zortech also contains a Make utility, a librarian, and a linker. Since Zortech uses standard object formats, the Microsoft librarian and linker may be used. No debugger is included, but Zortech C++ is CodeView compatible when using the Microsoft linker.

Although new, the Zortech C++ compiler has its roots in Zortech's ANSI C compiler, itself a reincarnation of the veteran Datalight C. (Walter Bright, the author of Datalight C, is also the author of Zortech's product.) While the package still shows a few blemishes of youth, such as the less-than-perfect integration of the editor and help utility with the remainder of the package, Zortech C++ is a powerful start for a powerful new language.

FACT FILE

Zortech C++, Version 1.05
Zortech Inc.
366 Massachusetts Ave.
Arlington, MA 02174
(800) 848-8408
List Price: Introductory price, good through year's end, $99.95; standard price, $149.95; includes ANSI C library and *Flash Graphics*.
Requires: 512K RAM, DOS 2.0 or later. Not copy protected.

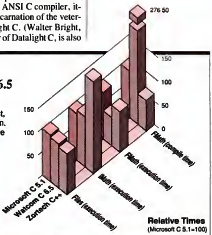
CIRCLE **435** ON READER SERVICE CARD

Benchmark Tests: Zortech C++ vs. Microsoft C 5.1 vs. Watcom C 6.5

Compiled without full optimization, Zortech C++ files execute reasonably fast, outperforming Microsoft C 5.1 files on all but the IMath benchmark program. You can expect even faster files from fully optimized compilations. However, we were unable to verify PC Labs test results when Zortech C++ ran with full optimization; those numbers are not shown.

Performance Times
(Times given in seconds)

	Files (execution time)	IMath (execution time)	FMath (execution time)	FMath (compile time)
Microsoft C 5.1	112.2	82 0	301 5	22 1
Watcom C 6.5	106 9	88 4	183.1	61.1
Zortech C++	98 8	161 4	263.6	14 5



Relative Times
(Microsoft C 5.1=100)

The **Files** benchmark program tests a C compiler's file-handling abilities. A compiler's level of performance on this test results both from its ability to optimize file-handling code and from the file-handling efficiency of its runtime library.

The **IMath** benchmark program tests a C compiler's ability to optimiza standard integer math operations. The test attempts to simulate the integer math operations performed in a variety of C program contexts.

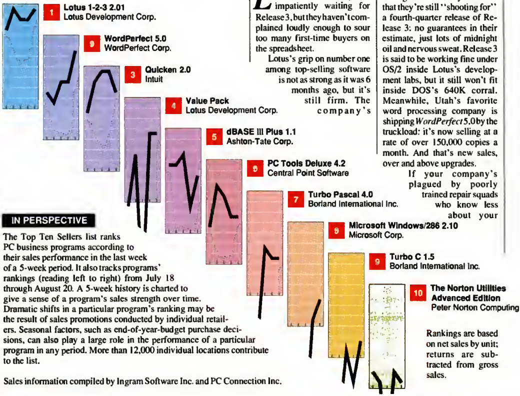
The **FMath** benchmark program tests a C compiler's ability to generate optimal floating-point math code, based on the compiler's ability to optimize floating-point operations and the efficiency of its floating-point library routines.

For a complete description of the PC Labs C Compilers benchmark tests, see *PC Magazine*, September 13, 1988, pages 162–164.

PIPELINE

TOP TEN SELLERS

(A 5-week history)



Lotus 1-2-3 users may be impatiently waiting for Release 3, but they haven't complained loudly enough to sour too many first-time buyers on the spreadsheet.

Lotus's grip on number one among top-selling software is not as strong as it was 6 months ago, but it's still firm. The company's management recently affirmed that they're still "shooting for" a fourth-quarter release of Release 3: no guarantees in their estimate, just lots of midnight oil and nervous sweat. Release 3 is said to be working fine under OS/2 inside Lotus's development labs, but it still won't fit inside DOS's 640K corral. Meanwhile, Utah's favorite word processing company is shipping *WordPerfect* 5.0 by the truckload: it's now selling at a rate of over 150,000 copies a month. And that's new sales, over and above upgrades.

If your company's plagued by poorly trained repair squads who know less about your

IN PERSPECTIVE

The Top Ten Sellers list ranks PC business programs according to their sales performance in the last week of a 5-week period. It also tracks programs' rankings (reading left to right) from July 18 through August 20. A 5-week history is charted to give a sense of a program's sales strength over time. Dramatic shifts in a particular program's ranking may be the result of sales promotions conducted by individual retailers. Seasonal factors, such as end-of-year-budget purchase decisions, can also play a large role in the performance of a particular program in any period. More than 12,000 individual locations contribute to the list.

Rankings are based on net sales by unit; returns are subtracted from gross sales.

Sales information compiled by Ingram Software Inc. and PC Connection Inc.

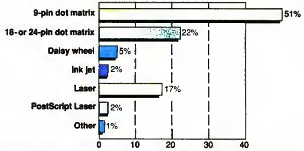
SURVEY

While planning this issue's printer blockbuster, we asked callers to PC MagNet about their printing interests.

Your feelings about the price you'd be willing to pay for a color laser printer are a reason why so few color printers of any stripe have been introduced. Color lasers do exist, but they command prices in excess of $25,000.

And while PostScript was important to only 46 percent of you, lower prices would probably make that feature a lot more appealing.

What type of printer do you currently use?



equipment than you do, you'll take heart from the latest trend in service.

Hewlett-Packard's joining IBM and Honeywell-Bull in offering maintenance for all types of PC hardware, no matter who made it, on a national basis. This has been the special preserve of local outfits and a few large independent chains like Soma and Sorbus.

To get off the ground, Hewlett-Packard will mobilize a staff of 750 engineers, and it guarantees a phone response within 2 hours or an on-site visit within 4 hours.

Prices vary wildly, depending on configurations and volume, but HP will have a tough time beating IBM, which has started to get a good reputation for price in the short time it's been competing.

Annual service contracts are generally negotiated at prices between 7 and 17 percent of a unit's cost.

Office Solutions Absorbed by Software Publishing

Is *OfficeWriter* ready for prime time? Software Publishing (maker of *Harvard Graphics*, *PFS:Professional Write*, and *PFS:First Choice*) recently acquired the word processor's parent company, Office Solutions, with the intention of adding more features to what it feels is one of the easiest word processors to learn.

OfficeWriter, like Ashton-Tate's *MultiMate*, bears a strong resemblance to the Wang word processing system and earned a following among renegades from the Wang system. It has enjoyed strong, if less than spectacular, success, and it generally ranked between five and ten among all PC word processing programs in sales.

The acquisition gives Software Publishing the chance to make further inroads into corporations without changing the friendly nature of *PFS:Professional Write*, currently outsold only by *Microsoft Word* and *WordPerfect*.

Office Solutions had sales of $4.3 million last year, while Software Publishing had sales of $38.6 million. Thanks to the success of *PFS:Professional Write*, *PFS:First Publisher*, and *Harvard Graphics*, however, the company has earned $49.2 million in the last three quarters.

> If your company's plagued by poorly trained repair squads, you'll take heart from the latest trend in service.

The real challenge for Software Publishing is to make *OfficeWriter* seem like a natural upgrade from *PFS:Professional Write*, without offending *OfficeWriter*'s current users.

To Micro Channel or Not to Micro Channel?

Rumors that IBM will introduce another low-end PS/2 (for example, a Model 30–like machine built around the AT bus) have been flying fast and have been just as furiously downplayed by IBM. "If anyone expects IBM to reintroduce the IBM AT, they are sadly mistaken," said one IBM spokesman. All indications suggest that sales of the AT-bus PS/2s greatly outnumber the Micro Channel machines.

IBM is facing a dilemma: a PS/2 with a 286 built around the old bus would surely sell very well, but it would undermine the company's pitch that the Micro Channel is superior. The new bus may be a technical wonder, but no one's yet come up with a single application where it outperforms the AT bus.

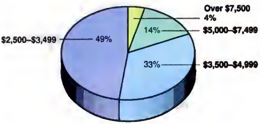
In this climate of confusion, Dell announced that it has indefinitely suspended its plans to introduce a Micro Channel PC. Dell said demand for the Micro Channel has lessened as most customers' curiosity about the Micro Channel has been sated.

Tandy, meanwhile, is slowly moving ahead with shipments of the Tandy 5000 MC. A small number of the Micro Channel–based PCs have gone to a select group of Tandy's corporate clients; machines should reach Radio Shack stores in late September.

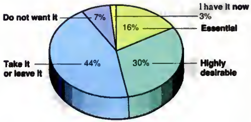
(By the way, if you're a *1-2-3* loyalist who envies *Microsoft Excel*'s rich display and print formatting options, check out Funk Software's new *1-2-3* add-in *Allways*, previewed on page 51. It's amazing.)

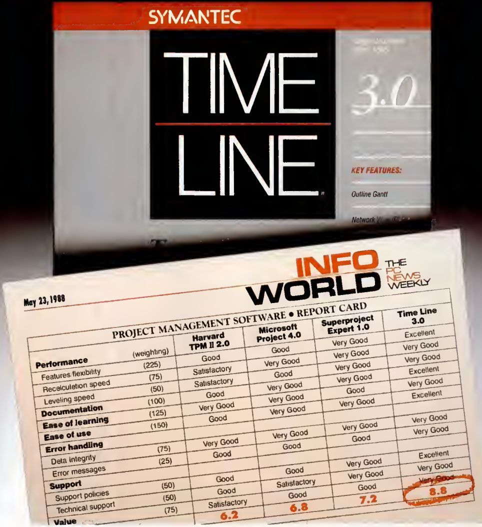
—Gus Venditto

What is the highest price you'd pay for a color laser printer?



How important will PostScript compatibility be in your next laser printer?





May 23, 1988

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Leveling speed	(100)	Good	Very Good	Very Good	Excellent
Documentation	(125)	Very Good	Very Good	Good	Very Good
Ease of learning	(150)	Good	Very Good	Very Good	Excellent
Ease of use					
Error handling	(75)	Very Good	Very Good	Very Good	Very Good
Data integrity	(25)	Good	Good	Good	Very Good
Error messages					
Support	(50)	Good	Good	Very Good	Excellent
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PC MAGAZINE Editor's Choice, '86 and '87

CIRCLE 249 ON READER SERVICE CARD

UniSaver Backup Power Supply Includes Nonvolatile RAM to Store System State

PC FACT FILE

UniSaver 100
Universal Vector Corp.
580 Herndon Pkwy., #400
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Requires: PC, XT, AT, or compatible using MDA, CGA, or EGA display. Hard disk needed to preserve RAMdisk

CIRCLE **433** ON READER SERVICE CARD

PC HANDS ON

BY WINN L. ROSCH

Like the miracle products advertised on UHF television, the UniSaver 100 combines several gadgets into one. Unlike its COD counterparts, the UniSaver proves to be a useful, if expensive, product.

The list of UniSaver 100 features is long and almost incongruous. The 3½- by 17½- by 14-inch (HWD) box functions as a power distribution and protection system, a backup power supply, a security system, a state-saver, and a hardware RAMdisk.

The $1,495 UniSaver package includes a full-length, XT-height, 8-bit expansion board bedecked with 768K of dynamic RAM and an 82C08 microprocessor; a heavy metal box with five switched outlets (three with individual on/off rocker switches); a pair of gelled-electrolyte batteries; and software. The box supplies battery power to the expansion board RAM using a 4-foot cable.

The UniSaver 100 repertory begins as a standby power supply with a difference. It supplies up to 345 watts (3 amps) of stepped square wave AC power when the utility line fails. But before its juice is drained away, the UniSaver 100 takes a snapshot of your system's DOS memory and registers, storing their contents in its own expansion board memory. Then the UniSaver 100 shuts down your computer system. The expansion board memory is kept alive by the UniSaver's battery reserves even after your computer shuts down.

When electrical power is restored, the UniSaver 100 loads the old memory and register states back into your system. You can start to work again exactly where you left off, in exactly the same place in your program—with all RAM-resident utilities loaded and ready for use. Leave your system on and unattended, and it won't lose its mind during the longest power outage—at least if it's shorter than the 48 hours the UniSaver 100 batteries can keep its thirsty NMOS RAM alive.

Instead of waiting for a power failure, you can press the "Placemark" button on the UniSaver front panel. The novel system obediently takes its snapshot of your computer's RAM. You can then do whatever you want: continue computing or reboot your computer. Press the Placemark button again and your computer flips back to the same state it was in when you pressed the button the first time—sort of like mechanical multitasking.

For security, a keyswitch on the UniSaver front panel locks the place-marked memory inside the UniSaver 100 and prevents anyone other than you from restoring it.

In this scheme, the 768K on the UniSaver board doesn't do anything until your lights go out. To make it more useful, the UniSaver 100 lets you put that RAM to work as a disk emulator. It gives you the speed of a RAMdisk but doesn't rob your system of any of its DOS or extended memory. And to make the virtual disk nonvolatile, the UniSaver 100 saves its contents to a reserved area on your system's hard disk whenever the 768K RAM is needed for holding a place mark.

Before its backup power is depleted, the UniSaver saves a copy of your system's RAM.

Photograph: Thom O'Connor

Hardware construction quality rates as very good, and the design is stylish. But the menu-driven setup, with its diagnostic software, still has rough edges. In testing it was tempermental and made no allowance for fast computers. For instance, a diagnostic test gives you a few seconds to press the Placemark button to make sure that part of the system is operating properly. On a 386-based PC, the test period whizzed past in the blink of an eye.

Moreover, the system's incompatibilities are limiting. The UniSaver 100 works with PCs, XTs, ATs, and compatibles but not PS/2s. It also wouldn't work on an 80386-enhanced AT. It works with MDA, CGA, and EGA video boards (some EGA video states are not saved because they are stored in write-only registers). Support for the Hercules and VGA graphics standards is planned. Unless you have a plain vanilla computer, you'll want to be sure the UniSaver will work on your system, or at least that you can return it if it doesn't.

The UniSaver 100 is a clever idea. Aside from the aforementioned limitations, it also works. Its biggest drawback is its substantial price.

At Last, a CD-ROM Controller for PS/2s

PC HANDS ON

BY DONALD B. TRIVETTE

How do you connect a CD-ROM player to your IBM PS/2 computer? Until now, you couldn't. Online Products has come to the rescue with a controller engineered for the IBM PS/2 Models 50, 60, 70, and 80.

The CDI-210S CD-ROM Controller is designed for the popular Sony CDU-100/CDU-5002 players; another version, the CDI-210H, works with the Hitachi 1503-S CD-ROM player. A modified cable costing $35 is necessary to connect the Sony drive to the board.

The controller occupies a single expansion slot and can control up to eight CD-ROM drives simultaneously. It has the capability to perform seeks on seven drives while reading data from an eighth. Installation is a breeze. In keeping with the Micro Channel's ability to recognize add-on hardware and configure itself accordingly, the CDI-210S needs no jumpers or switches.

List Price: CDI-210S CD-ROM Controller, $295. **Requires:** IBM PS/2 Model 50, 60, 70, or 80; Sony or Hitachi CD-ROM player. Online Products Inc., 20251 Century Blvd., Germantown, MD 20874; (800) 922-9204; (301) 428-3700.

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CIRCLE 254 ON READER SERVICE CARD

The Latest in Port-to-Port File Transfer

HANDS ON

BY JENNIFER ZAINO

Someday all desktop computers may be equipped with 3½-inch disk drives, so that transferring data to laptops or PS/2s will be a simple matter of moving a floppy disk from one to the other. In the meantime, *3X-Link*, from 3X USA, and *The Flying Dutchman*, from CYCO International, aim to make the process a little less awkward.

The $149 *3X-Link* works through the serial port; a 30-foot cable with both 9-pin and 25-pin connectors on each end is included with the package. The program is unique in that it can be run in standalone or RAM-resident mode, popping up at the touch of a hotkey.

In an especially nice touch, *3X-Link* can be loaded in memory-resident mode on a local system and in background mode on a remote PC; initiating a session from the local system interrupts any application running on the remote PC until data transfer is complete.

Another unusual aspect of the program is its full-background print feature, which enables the local computer to share the parallel printer of the remote PC, without interrupting the work in progress on either machine.

While *3X-Link* is respectably speedy (data transfer takes place at rates of up to 115.2K), it lagged a little behind *LapLink* in our file transfer tests. You can change the program's parameters to transfer data at the even slower speed of 38,400 bits per second (which you'll need to accommodate IBM Model 80s), as well as to indicate which serial port to use and whether to transfer hidden files or to disable a remote keyboard.

A variety of options are available to you in connect mode, including sending files and directories; moving files and then deleting them from the source PC with a single command; displaying a directory tree; and creating, deleting, searching, and renaming directories. You can also use wildcards.

One of the program's nicest features is its autoscript function, a macro utility that can be of considerable help in expediting routine file-transfer chores.

The Flying Dutchman uses parallel ports instead of serial and transfers data at approximately 220,000 bps via an included 6-foot cable. The manual boasts that the contents of a 20MB hard disk can be transferred in 14 minutes or less under ideal conditions; our 10MB test file transferred in slightly less than 9 minutes.

This is simple-to-use, barebones software. The main menu presents you with a sparse list of choices: sending and receiving files and directories, testing the connection cable, and quitting the program.

You can also use function-key commands to cancel an action or access DOS or *WordPerfect Library* Shell gateways (the program uses the same function keys as *WordPerfect*). Hitting the F3 key will bring up a help screen, which explains the few options you can run directly from the DOS prompt.

FACT FILE

3X-Link
3X USA
One Executive Dr.
Fort Lee, NJ 07024
(201) 592-6874
List Price: $149
Requires: 256K RAM, serial port on each PC, DOS 2.0 or later. Not copy protected.

CIRCLE 431 ON READER SERVICE CARD

The Flying Dutchman
CYCO International
ADN Marketing
1908 Cliff Valley Way
Atlanta, GA 30329
(404) 634-3302
List Price: $99.95
Requires: 62K RAM, parallel port on each PC, DOS 2.0 or later. Not copy protected.

CIRCLE 430 ON READER SERVICE CARD

If simplicity and speed are what you need, *The Flying Dutchman* could be the data transfer program for you. If you prefer a program that offers a wider variety of options, *3X-Link* is a wiser choice.

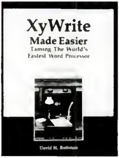
A Lighthearted Approach To Mastering XyWrite

BOOK REVIEW

BY JONATHAN MATZKIN

XyWrite is surely one of the most powerful word processors, but it is just as surely one of the most intimidating. *XyWrite Made Easier: Revised and Expanded for XyWrite III Plus*, by David H. Rothman, leads you through many of the program's most useful features; more importantly, it emphasizes techniques for molding *XyWrite* to suit your particular needs.

XyWrite Made Easier begins slowly. Chapter 4, "The Two-Hour XyWriter," covers some of the basic steps in creating, formatting, and outputting a document. Reading through this basic material is unexpectedly amusing (or annoying, depending on your preferences), since Rothman abandons the conventional dry tutorial approach in favor of a mock dialogue among fictional *XyWrite* users.



Chapter 5 delves into the mysteries of *XyWrite*'s STARTUP.INT file, one of the structures that give *XyWrite* its power and differentiate it from other word processors. Rothman maintains the dialogue approach of the earlier chapters, and this seems to make the material sink in a little more easily. Here—and throughout the book—Rothman emphasizes the ways in which *XyWrite* can be configured for maximum efficiency from the fewest keystrokes.

Customizing *XyWrite*'s keyboard is next, and by this time the going has gotten considerably steeper. Novices may wither in the face of what starts to look suspiciously like programming. But the material is lucidly laid out and rewards attentive reading. Printer files get their own chapter, and Rothman also devotes a chapter to preparing *XyWrite* files for transmission via modem.

FACT FILE

XyWrite Made Easier: Revised and Expanded for XyWrite III Plus
By David H. Rothman
TAB Books Inc.
Blue Ridge Summit, PA 17294
(800) 233-1128
(717) 794-2191 (Alaska and Pennsylvania)
ISBN: 0-8306-3040-6
List Price: Paperback, $21.95

CIRCLE 432 ON READER SERVICE CARD

The rest of the book consists of tips from *XyWrite* users. Productivity tips from playwright Arthur Kopit and novelist Richard Bach make this book an even more fun way to master *XyWrite*.

Photograph Thom O'Connor

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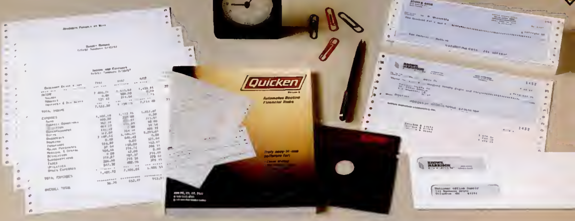

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Graph-Mania Adds 160-Column Display, Pop-up Graphics to 1-2-3

HANDS ON

BY DONALD B. TRIVETTE

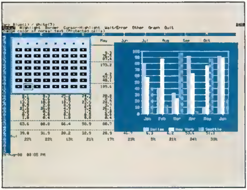
Graph-Mania, from PC Publishing, has two enhancements to offer *Lotus 1-2-3* spreadsheet users. First, it can more than double the amount of information your EGA or VGA monitor displays and the colors it uses to display it; second, it turns the Lotus graph command into a dynamic graphics window.

Graph-Mania is a memory-resident add-on product for *1-2-3*. Depending on which options and features you use, you'll have to give up from 35K to 52K RAM.

In addition to the standard 80 columns by 25 rows, *Graph-Mania* lets you give your *1-2-3* spreadsheets three new resolutions: 106 columns by 45 rows, 128 columns by 50 rows, and 160 columns by 58 rows. The 160-column spreadsheet is hard on the eyes. But options designed also to help you dress up the standard *1-2-3* display let you adjust the screen to make the high-resolution modes easier to work with.

One such option alters the spreadsheet border and text colors, another reverses the background and foreground, and still another temporarily turns lowercase text into uppercase. The package also includes seven display-only text fonts ranging from Old English to Sans Serif. The Sans Serif, when used with the uppercase option, makes the 160-column by 58-row display almost comfortable.

The second enhancement *Graph-Mania* brings to *1-2-3* is a graphics window. This allows the standard *1-2-3* graphs—line, bar, and pie charts—to be displayed over the top of the spreadsheet. You can specify whether changes in the spreadsheet data will be reflected immediately in your graph.



Graph-Mania *pops up a movable graphics window over* Lotus 1-2-3 *and squeezes more data on the screen. You pick colors from the* Graph-Mania *palette.*

The functions of the Lotus graph command are unchanged, but *Graph-Mania* menu options let you select colors by data range and set the size and location of the graph window.

All in all, *Graph-Mania* is easy to install and use and adds plenty of features to *1-2-3* for a reasonable price. If you're weary of *1-2-3*'s stodgy look and inflexible graphics, *Graph-Mania* may be just what you need.

FACT FILE

Graph-Mania
PC Publishing Inc.
1801 Avenue of the Stars
Los Angeles, CA 90067
(213) 556-3630
List Price: $99.95
Requires: 64K RAM; *Lotus 1-2-3*, Release 2.0 or later; EGA or VGA display; DOS 2.0 or later.

CIRCLE **437** ON READER SERVICE CARD

Word for Word 3.0 Adds XyWrite Conversions and Network Version

HANDS ON

BY DONALD B. TRIVETTE

Switching from one word-processing program to another surely ranks as one of life's little miseries. What do you do with all the old files that aren't compatible with your new word processing application? If you have a copy of *Word for Word*, you simply convert everything to the new format.

Word for Word converts word processing files from one format to another. It speaks a host of popular dialects, including *WordStar*, *WordPerfect*, *Volkswriter*, *PFS*, and *Microsoft Word*. You simply select the source format, the target format, and provide a filename—the program does the rest.

The new version, *Word for Word* 3.0, supports one new word-processor format, *XyWrite III*, as well as upgrades for four previously supported word processors: *Word*, *MultiMate*, *PFS:First Choice*, and *WordStar*. It comes in three editions: the Professional edition has 17 formats; the Limited edition has 10 formats; the LAN version has a different user interface that supports multiple workstations.

The more sophisticated the word processor, the better the translation. For example, *Microsoft Word* files translate almost 100 percent into *WordPerfect* files because both programs are rich in features. When *Word for Word* fails to translate a feature, it embeds an error message in the appropriate place in the target file and notes the exception in a report file.

A 20,000-byte file, translated from *WordStar* to IBM's *DCA*—the slowest case—takes about 2 minutes on an XT-class computer; my ASCII translation took less than 20 seconds.

After you've stepped through the *Word for Word* menus a few times, you'll wish for an expert mode that would allow you to enter all information on a command line. But all in all, *Word for Word* is so easy to use that any complaint seems minor. It sure beats manual conversions.

FACT FILE

Word for Word
Mastersoft Inc.
4621 N. 16th St., Suite B-210
Phoenix, AZ 85016
(800) 624-6107
(602) 277-0900
List Price: Professional, $149, Limited, $79.95; LAN (three users), $299.
Requires: 256K RAM, DOS 2.0 or later (LAN DOS 3.0 or later). Not copy protected.

CIRCLE **436** ON READER SERVICE CARD

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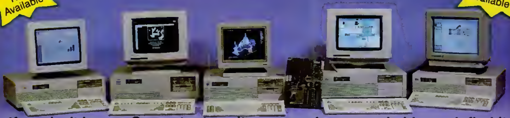

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CIRCLE 390 ON READER SERVICE CARD

NEW ON THE MARKET

by Jonathan Matzkin

The CrystalPrint Publisher ($4,499) is intended to compete with the Apple LaserWriter IINTX. It has Casio's LCD print engine and o RISC-based controller.

CrystalPrint PostScript Printer Among First to Use Weitek Chip Set

The CrystalPrint Publisher, a $4,499 PostScript printer, offers the speed of the Apple LaserWriter IINTX at a lower price, according to **Qume.**

The 300-dot-per-inch printer uses Casio's LCD page-printer engine and a Qume RISC printer controller, which incorporates the Weitek HyperScript-Processor XL-8200 RISC chip set. The system comes with 3MB RAM.

The CrystalPrint Publisher has 11 built-in font groups, for a total of 35 typefaces. The printer also supports Qume downloadable fonts. Its small footprint measures 9.1 by 15.7 by 13.4 inches (HWD).

List Price: CrystalPrint Publisher, $4,499. Qume Corp., 500 Yosemite Dr., Milpitas, CA 95035; (408) 942-4000.

CIRCLE **441** ON READER SERVICE CARD

Full-Featured Network Shares Peripherals and Files for $125 a Node

Equinox Systems offers SwitchLAN-8, an economical twisted-pair network that allows "hotkey" file transfer, printer sharing, and terminal emulation. The "zero slot" LAN requires no network server and does not connect to node PCs with internal cards. Instead, twisted-pair wiring connects the PC's serial ports to a network hub. The basic system, including an eight-user software license and one eight-user hub, costs $995. The system can be expanded to support up to 16 computers with the addition of a second hub.

The software is memory resident and has a series of pull-down menus for selecting printers, managing the print queue, transferring files between nodes, and other network operations.

List Price: SwitchLAN-8, $995 for eight-user system. **Requires:** 90K RAM, DOS 3.0 or later. Equinox Systems Inc., 14260 SW 119 Ave., Miami, FL 33186; (305) 255-3500.

CIRCLE **443** ON READER SERVICE CARD

FreeStyle EVGA Edits, Displays Targa Images Without a Targa Board

FreeStyle EVGA, a graphics paint program from **Everex Systems,** reads and writes images in the Targa file format without requiring the Targa board. The software runs on the Everex EVGA graphics adapter; it does not support other graphics cards. *FreeStyle EVGA* costs $299, and the required EVGA card lists for $399, making the combination

(continues on page 52)

HOT PROSPECT

Allways Brings Presentation-Quality Output to 1-2-3 Worksheets

Many spreadsheet users have adopted *Microsoft Excel* because of its powerful formatting and presentation features. *Allways*, a $149.95 add-in utility from **Funk Software,** gives *1-2-3* users (Releases 2.0 and 2.01) similar control over the look and layout of their worksheets.

Allways has multiple fonts, three levels of shading, and character attributes such as boldface, underline, and double underline. Users can easily merge spreadsheet data with graphs on the same printout, according to Funk. Line and box drawing is also possible.

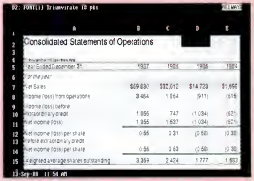
All of these features are visible in a WYSIWYG display that is updated as soon as a change is made.

Supported printers include the HP LaserJet and compatibles, PostScript devices, and IBM- and Epson-compatible dot matrix machines. *Allways* can use any built-in font of the supported printers. In addition, the package comes with several bit-mapped typefaces that range in size from 5 to 24 points. These fonts are printed either by downloading, as with the HP LaserJet Series II, or through graphics mode, as with dot matrix machines.

Allways uses a Lotus-like menu structure to minimize learning time.

List Price: *Allways*, $149.95. **Requires:** 384K RAM; *Lotus 1-2-3*, Release 2.0 or 2.01; DOS 2.0 or later. Not copy protected. Funk Software Inc., 222 Third St., Cambridge, MA 02142; (617) 497-6339.

CIRCLE **438** ON READER SERVICE CARD



```
D2: FONT(1) Triumvirate 18 pts                                   ALLWAYS
                          A                   B        C        D        E
 1
 2  Consolidated Statements of Operations
 3
 4  [illegible]
 5  Year Ended December 31,               1987     1986     1985     1984
 6  or the year
 7  et Sales                            $69 830  $32,012  $14 723   $1,696
 8  come (loss) from operations           3 454    1 864    (911)    (615
 9  come (loss) before
10  xtraordinary credit                   1 855      747  (1 034)    (62
11  et income (loss)                      1 855    1 537  (1 034)    (521
12  et income (loss) per share             0 55     0 31   (0 58)    (0 38
13  efore extraordinary credit
14  et income (loss) per share             0 55     0 63   (0 58)    (0 38
15  eighted average shares outstanding    3 359    2 424    1 777    1 563
13-Sep-88  11 54 AM
```

Allways, *a $149 95 formatting and printing utility for 1-2-3, lets Lotus users turn out the sort of spiffy worksheets that have helped popularize* Microsoft Excel

NEW ON THE MARKET

FreeStyle EVGA

(continued from page 51)

considerably less pricey than a Targa board with associated graphics software.

Everex says that image databases and presentation graphics material can migrate to the EVGA card while maintaining compatibility with the higher-end Targa standard. An included utility, called *XForm*, converts images to 256-gray-scale encapsulated PostScript or .TIF formats. These images can then be imported into leading desktop publishing packages such as *Ventura Publisher* or *PageMaker*.

List Price: *FreeStyle EVGA*, $299. **Requires:** 512K RAM, mouse, Everex EVGA graphics adapter, DOS 2.0 or later (1.5MB EMS suggested for optimum performance). Everex Systems Inc., 48431 Milmont Dr., Fremont, CA 94538; (415) 498-1111.

CIRCLE **445** ON READER SERVICE CARD

NSA Board Gives IBM PS/2s a Flexible Link To Large System Hosts

Network Software Associates has unveiled the AdaptCoax 2, a $595 multiprotocol communications board that attaches Micro Channel PS/2 systems to IBM 3274 or 3174 controllers via coaxial cable. The board works with *AdaptSNA* software packages to support PS/2-to-host communications through a 3274/31745 using any one of four IBM systems network architecture (SNA) protocols. It supports LU6.2/APPC, interactive 3270, batch-oriented 3770/RJE, and LUO protocols. NSA says that coaxial-attached PCs are normally limited to the 3270 protocol.

AdaptCoax 2 fits in a Micro Channel expansion port and connects with coaxial cable to the 3274/3174 controller, which is in turn connected to the host system.

List Price: AdaptCoax 2, $595. **Requires:** PS/2 Model 50, 60, 70, 80, or compatible; *AdaptSNA* software; expansion port. Network Software Associates, 22982 Mill Creek, Laguna Hills, CA 92653; (714) 768-4013.

CIRCLE **442** ON READER SERVICE CARD

Emerson Computer Adds the Inexpensive SW1000 UPS to Its Power Protection Line

Emerson Electric Co., a manufacturer of uninterruptible power systems, has debuted the $695 Emerson SW1000 UPS. The new system is a low-cost version of the company's PC-ET desktop UPS, according to Emerson. The SW1000 maintains continuous filtered power and supplies backup power during brownouts or blackouts. The unit also offers powerline-noise and transient suppression. In the event of a power failure, the SW1000 supplies up to 10 minutes of battery power to allow you to safely shut down your PC.

If the computer is unattended during a power failure, the SW1000's "status connector" notifies the system of the power failure. When the UPS batteries are low, a second warning is issued, allowing the computer to shut itself down.

The compact system is designed to fit under a PC monitor and measures 2.3 by 17 by 18.3 inches (HWD).

List Price: Emerson SW1000 UPS, $695. Emerson Electric Co., Industrial Controls Division, 3300 S. Standard St., P.O. Box 1679, Santa Ana, CA 92702; (714) 545-5581.

CIRCLE **439** ON READER SERVICE CARD

The Emerson SW1000 UPS ($695) fits conveniently under your monitor and gives you 10 minutes to power-down in the event of a blackout.

Intel Introduces Communications Board

The Connection CoProcessor for AT-bus PCs makes PC communications as simple as sending a document to a printer, **Intel** says. The board is the first in a series of communications add-in cards from Intel, and it is the first product to support the DCA/Intel communicating applications specification (CAS).

The Connection CoProcessor ($995), from Intel, supports the DCA/Intel communicating application specification (CAS), allowing for simple, flexible communications.

The public-domain CAS, jointly developed by Intel and DCA, allows transmission of text, graphics, and binary files over phone lines, via 9,600-bit-per-second file transfer, to other Connection CoProcessor–equipped PCs. The $995 Connection CoProcessor uses a 10-MHz 80188 processor and 256K RAM to offload communications chores from your system's main processor. Intel claims that the board transfers files four to eight times faster than traditional modems. It can also send fax and e-mail messages to all group III fax machines and receive fax messages with appropriate software.

Add-ins and enhancements for such popular packages as *Lotus 1-2-3*, *SideKick Plus*, *Q&A*, and *WordPerfect* will enable users to transmit files and fax messages via simple menus or function-key commands without leaving the foreground application.

The Connection CoProcessor has a piggyback connector intended for a series of communications options. The first of these is the Connection CoProcessor 2400B modem option, a 2,400-bps Hayes-compatible modem that costs $295.

List Price: Connection CoProcessor, $995. **Requires:** Full-length slot. Intel Corp., Mail Stop C03-07, 5200 NE Elam Young Pkwy., Hillsboro, OR 97124; (503) 629-7354.

CIRCLE **440** ON READER SERVICE CARD

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CIRCLE 205 ON READER SERVICE CARD

ATI's 2400etc Brings Error Correction to the Masses

HANDS ON

BY HOWARD MARKS

I've long been a proponent of error-correcting modems, but the high prices modem vendors charge for them have kept most buyers away. ATI Technologies' latest wonder—the ATI 2400etc modem—brings error correction to the masses.

Priced at $239, the ATI 2400etc internal modem boasts full support for Class 5 MNP (see the sidebar "MNP: Squeezing the Most Out of Your On-line Charges"); similar products retail at $500.

The 2400etc has all the features you'd expect from an internal modem. It can be set up for COM1 to COM4 via switches, easily accessible through a hole in the mounting bracket, and the line and phone jacks are clearly labeled. ATI has even managed to include a perfectly readable manual—a trick most modem manufacturers have yet to master.

The ATI 2400etc passed all our tests with flying colors. Even with its MNP feature disabled, I had no trouble with noisy lines that often mean trouble for other modems. The modem also proved its Hayes compatibility without fault. I had no problems running it with several communications packages, including *Lotus Express*, *Relay Gold*, and the notoriously picky *Smartcom III*. The ATI 2400etc comes with a special version of the *Mirror II* communications package, a step up from the software that most modem vendors supply.

All in all, the ATI 2400etc is a fine internal 2,400-bit-per-second modem with complete support for Class 5 MNP and exceptional Hayes compatibility. Combine this with its $239 list price and you have a real winner.

FACT FILE

ATI 2400etc
ATI Technologies Inc.
3761 Victoria Park Ave.
Scarborough, Ontario
Canada M1W 3S2
(416) 756-0711
List Price: $239
Requires: DOS 2.0 or later.

CIRCLE **447** ON READER SERVICE CARD

MNP: Squeezing the Most Out of Your On-line Charges

Microcom Networking Protocol (MNP) is an industry standard for modem-to-modem error correction. Like Xmodem and other file-transfer protocols, MNP breaks the data stream into blocks and verifies that each block was received correctly.

MNP Classes 3 and higher send data between the two modems synchronously, as opposed to the usual PC asynchronous mode. This speeds transmissions by avoiding the necessity of sending start and stop bits with each byte.

MNP Classes 4 and up automatically adjust block size to line conditions (bigger blocks to reduce overhead on good lines and smaller blocks to reduce retransmissions on noisy lines).

MNP Class 5 adds a data compression feature that speeds transmission by 10 to 80 percent, depending on the type of data being transmitted.

Telenet, CompuServe, and many bulletin boards accommodate Class 5 MNP. The speed increase and error-correcting features make using these services much more pleasant and productive.—Howard Marks

Kedit Adds EMS Support, Rexx Subset

HANDS ON

BY SALVATORE P. RICCIARDI

Mansfield Software Group's latest release of *Kedit*, a full-screen text editor for PCs and compatibles, is likely to continue to inspire an already loyal following. Version 4.0 has been completely rewritten in C and hosts a number of enhancements, including a built-in subset of the Rexx programming language (called Kexx), EMS support for editing larger files, and support of Xedit's selective line-editing facility.

Kedit combines the best of two worlds: you can use the command line if you want to, or you can bind commands to specific keystrokes using the macro facility. The package ships with a default set of key assignments.

The package is known for its blinding speed, and the new release continues in this tradition. Much of its speed can be attributed to *Kedit*'s loading the entire work file into RAM. This results in extremely fast operation, but it also means you can't edit files larger than available memory. Luckily, Version 4.0 adds support for the LIM extended memory specification, allowing you to edit larger files.

You can keep up to 15 files in memory at one time and can display portions of up to eight files in eight definable windows. You can also edit portions of the same file in different windows, with changes made immediately visible in both.

Several types of blocks are supported: line blocks, box blocks, and stream blocks. Moving and copying blocks between files and windows are easy and fast procedures.

In a particularly handy feature, *Kedit* allows you to mark a box block around an area of text and shift the entire block to the right one character at a time. This is especially useful for indenting source code, since the data to the left or right of the marked block is not moved.

Kedit's internal command set is rich. Using Kexx, macros can be created with full access to the *Kedit* environment. Macros can modify the *Kedit* environment and any of the files currently being edited. They can also pass commands to *Kedit* for execution. The macro language supports variables, do loops, if-then-else constructs, and command arguments, and it can receive input and display output. Any *Kedit* macro or sequence of macros can be assigned to a key.

Personal Rexx, sold separately by Mansfield Software Group, is a standalone implementation of the SAA standard Rexx programming language. It can be used as an enhanced batch language and as an enhanced programming facility for *Kedit*, and it can pass commands to DOS for execution.

An OS/2 protected-mode version of *Kedit* is available now; a version of Personal Rexx for OS/2 is in the works.

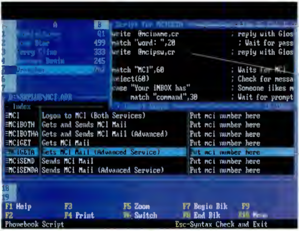
Kedit was originally designed as a PC implementation of Xedit, an IBM mainframe text editor. While *Kedit* remains true to its heritage in retaining compatibility with the mainframe Xedit, it is also one of the most feature-packed PC text editors around.

FACT FILE

***Kedit*, Version 4.0**
Mansfield Software Group
P.O. Box 532
Storrs, CT 06268
(203) 429-8402
List Price: DOS version, $150; OS/2 version (includes OS/2 and DOS modules), $175.
Requires: 384K RAM, DOS 2.0 or later. Not copy protected.

CIRCLE **446** ON READER SERVICE CARD

SideKick Plus Gives Your PC the Power of Communication!



Get full communications capabilities without leaving Quattro—or any other application you're using

Online Help is always available

Ready-to-use scripts make it easy to log onto MCI, CompuServe, or BIX

Define your password and encrypt it for security

Add in your local access number with a simple entry

```
write  @mciname,cr             ; reply with Glos
match "word: ",20              ; Wait for pass
write  @mcipsw,cr              ; reply with Glos

match "MCI",60                 ; Waits for MCI
select(60)                     ; Check for messa
case "Your INBOX has"          ; Someone likes m
     match "command",30        ; Wait for prompt
```

```
- Index
≡MCI      Logon to MCI (Both Services)          Put mci number here
≡MCIBOTH  Gets and Sends MCI Mail               Put mci number here
≡MCIBOTHA Gets and Sends MCI Mail (Advanced)    Put mci number here
≡MCIGET   Gets MCI Mail                         Put mci number here
≡MCIGETA  Gets MCI Mail (Advanced Service)      Put mci number here
≡MCISEND  Sends MCI Mail                        Put mci number here
≡MCISENDA Sends MCI Mail (Advanced Service)     Put mci number here
```

It's a full-fledged communications program for data and voice … plus a lot more!

Communication is power. And with SideKick® Plus, it's at your fingertips. Because SideKick Plus is the only communication software you need. To send your message around the world. Or to pick up messages from MCI or Dow Jones or any other electronic service. Automatically—even if you're down the hall in a meeting. Or doing something else you do on your PC. (Try asking CrossTalk® software to do that!)

SideKick Plus saves you time and keystrokes with sample scripts for popular programs like MCI® Mail, CompuServe,® and BIX.® You can create scripts by simply recording your keystrokes, or edit scripts to access the full power of the script language.

Turbo charge your Phonebook

SideKick Plus lets you create the most high tech address books you've ever seen—entering names and addresses in the form you choose. Searching electronically for the information you need. And attaching notes and comments about each person listed.

SideKick Plus is communications and more: seven powerful software packages in one!

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- A sophisticated DOS file manager
- A calendar you can use as a common scheduler if you're on a local area network
- Multiple notepads
- A phonebook with full communications
- Your choice of four different calculators
- An ASCII table

Plus:

- Support for both expanded and extended memory. If you have an Intel Above® Board, you can take full advantage of your 640K of RAM and yet use all your SideKick Plus desk accessories at any time.
- All completely integrated and instantly accessible over any other application you're working in
- All taking up as little as 72K of your computer's RAM

Minimum System Requirements: For IBM PS/2, IBM family of personal computers, and all 100% compatibles. Operating system: PC-DOS (MS-DOS) 2.0 or later. Minimum system memory: 384K bytes. Minimum resident memory size: 72K. Hard disk required. Supports both EMS and extended memory.

*Customer satisfaction is our main concern. If within 60 days of purchase this product does not perform in accordance with our claims, call our customer service department, and we will arrange a refund.

BI 1238A

CIRCLE 137 ON READER SERVICE CARD

> “The built-in communications program is very impressive … Unlike most communications programs (including some that cost twice as much as SideKick), the new SideKick lets your computer communicate with another machine while you are running another program.
>
> *—Lawrence Magid, Washington Post*”

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To buy this kind of communication power and all the other SideKick Plus features separately, you'd spend hundreds of dollars and drain your computer's memory dry. Instead, just see your Borland dealer and get the power of SideKick Plus!

Hard disk required.

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BORLAND
INTERNATIONAL

$70 Comm Package Lets You Customize Menu, Supports Multiple Connections

HANDS ON

BY EDWARD MENDELSON

A communications program with unique features and a low price is as rare as a noisefree line from New York to New Zealand. *PereLine*, a $69.95 package from Peregrine Data Systems, combines convenience with customizability and throws in tricks many expensive packages will envy.

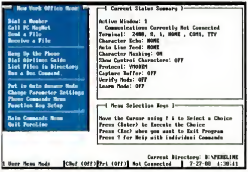
PereLine, which runs equally well from menus or keyboard shortcuts, lets you create a fully customized opening menu. You can write different menus for everyone in the office and let inexperienced users run elaborate command files by hitting a single key. You won't even have to learn a script language. When you turn on *PereLine*'s learn mode, it converts your keystrokes and the messages from the remote computer into a script file you can use without modifying. The script language isn't as complex as those in *Crosstalk* or *ProComm Plus* but should be adequate for most communications and file-management tasks.

One feature, which resembles the merge function in a word processor, lets you use the same script with different telephone numbers in turn or makes it easy to change one of the messages in a script without asking users to mess with a file full of commands.

Most communications packages automatically configure themselves for Hayes modems but force you to type in obscure codes if you want to use anything else. *PereLine* supports 18 modems and makes it easy to set up any oddball model.

PereLine supports four COM ports on XTs and ATs, eight on PS/2s. Using two COM ports, you can connect to two remote computers simultaneously and switch between them with windows.

PereLine stores your last 25 commands and lets you replay them. It lets you copy or rename files without jumping to DOS, and a simple command will send a list of files in a directory to the remote computer. Its host mode incorporates a simple password security system and can allow access to DOS from the remote computer. The standard and batch versions of Xmodem and Ymodem protocols are built in, along with *Telink* and *Kermit*. Emulated terminals include the DEC VT-100 and VT-52, the IBM 3101, and the Data General DG210.



```
[ Current Status Summary ]

Active Window: 1
  Communications Currently Not Connected
Terminal:  2400, 8, 1, NONE , COM1, TTY
Character Echo: NONE
Auto Line Feed: NONE
Character Masking: ON
Show Control Characters: OFF
Protocol: YMODEM
Capture Buffer: OFF
Verify Mode: OFF
Learn Mode: OFF

[ Menu Selection Keys ]

Move the Cursor using ↑ ↓ to Select a Choice
Press <Enter> to Execute the Choice
Press <Esc> when you want to Exit Program
Press ? for Help with individual Commands

                                   Current Directory: D:\PERELINE
1 User Menu Mode    CBuf (Off) Prt (Off) Not Connected    7-27-88  1:38:11
```

PereLine *makes it easy to link elaborate scripts to menus you create. It includes four file-transfer protocols and a password-protected host mode.*

PC FACT FILE

PereLine
Peregrine Data Systems
5365 Baron Dr.
San Jose, CA 95124
(408) 356-6105
List Price: $69.95
Requires: 256K RAM, DOS 2.0 or later. Not copy protected.

CIRCLE **447** ON READER SERVICE CARD

Although *PereLine*'s keyboard shortcuts and menu structure differ from the familiar layout used by *ProComm*, *Boyan*, and *PC-Talk*, you won't have any trouble learning your way around. Experienced users may have to overcome their reluctance to press Alt-H for detailed help, because in many other programs the same key hangs up the modem. For nonexpert users, one minor problem is the lack of any on-screen hint of which key to press for help or an on-line menu. But you can program the function keys so that F1 pops up a reassuring menu.

Peregrine Data Systems maintains a BBS for customer support, but you'll probably never need it. *PereLine* lacks conveniences that make *Boyan* and *ProComm* stand out among low-priced packages. But for office use, *PereLine*'s features leave it with few rivals anywhere near its price.

A Disquieting Way to Protect Your PC

HANDS ON

BY JONATHAN MATZKIN

It's great that PCs are so small and portable, but their size also makes them easy to steal. When was the last time you heard of someone walking away with a DEC 20 mainframe? The AlarmCard is a combined hardware-and-software system that emits a *loud*, piercing beep if someone tries to move your system when the power is off.

The device has three main components: a half-card that goes in any available 8- or 16-bit classic bus slot; a battery/alarm unit that mounts inside your system's cover; and a program called PCALARM.EXE, which arms the system.

You configure the software to monitor your system unit for movement away from horizontal or vertical placement. If someone disturbs its position when the power is off, the alarm is triggered. PCALARM.EXE demands a password when you run it, to protect against tampering with the alarm. By calling the program from your AUTOEXEC.BAT file, you can effectively password-protect your system: no password, no access to DOS.

To prevent someone from opening your system cover and simply ripping out the AlarmCard's internal speaker, the device is shipped with a tamper-resistant screw that replaces one of the screws that hold down the cover. It's a hex screw, and it comes with a special wrench. Unfortunately, the screw didn't fit my Dell System 310.

The AlarmCard will keep amateur snoops from stealing your data or your entire PC. But it won't stop a serious criminal. The tool for turning the hex screw is readily available, after all.

And by pressing Ctrl-C, you can abort your AUTOEXEC.BAT file before the password protection is armed, thereby allowing access to your data. That does not disarm the motion sensor, however.

List Price: AlarmCard, $119.95. **Requires:** Half slot. Software not copy protected. The AlarmCard Co., 14700 NE 8th St., #205, Bellevue, WA 98007; (206) 747-0824.

CIRCLE **452** ON READER SERVICE CARD

Get Sprint and you'll never be afraid of the dark!

Forgetting to "Save" is a fact of life as are power outages, and it used to be that a power outage could wipe out everything you've done. Not any more. Your work is always safe when you Sprint.*

Sprint's "Auto-Save" automatically saves your words as you type, so if the lights do go out, you may be in deep darkness but not deep trouble.

Sprint's Auto-Save is more than "insurance," it's also invisible. You know it's there, but it does its job without interrupting yours.

Sprint: It's the word processor with everything!

You name it, Sprint's got it. Incredible speed, Auto-Save, a customizable user interface, and professional output. Sprint even includes a bonus pack of alternative user interfaces that make it act like WordStar,® MultiMate,® WordPerfect,® Microsoft® Word, or other familiar word processors—a $99 value free!

Sprint has all this and does all this for $199.95 instead of the up to $600 that some companies demand. Sprint automatically saves your words; it also automatically saves your money. Sprint—The fast track to performance word processing.

Nothing holds a candle to Sprint!

Features ● = Yes ○ = No	Sprint 1.0	WordPerfect 4.2	MS Word 4.0	WordStar 4.0	MultiMate Adv. II, 1.0
Maximum file size	Disk	Disk	Disk	Disk	128K
Thesaurus (integrated)	●	●	●	●	●
Windows Open (maximum)	6	2	8	1	1
Files Open (maximum)	24	2	8	1	1
Cross-Reference (dynamic)	●	○	○	○	○
Indexing Options	7	1	3	3	○
Columns: Parallel	●	●	●	●	●
Snaking (chg. # same page)	●	●	Not same pg.	○	●
H-P LaserJet Support	Full	Partial	Full	Partial	Full
PostScript Support	Full	Text	Full	○	Text
Mouse Support (integrated)	●	○	●	○	○
Dynamic Shortcuts	●	○	○	○	○
Alternative User Interfaces	●	○	○	○	○
Verify Spelling as you type	●	○	○	○	○
Programmable Macro lang.	●	○	○	○	○
Save File[1]	5.9	41.1	9.7	4.4	1.0
Top to Bottom[2]	7.5	7.5	49.4	8.1	21.0
Search and Replace[3]	1.6	6.6	4.6	17.1	13.4
Find Unique Word	3.3	6.2	7.0	13.8	20.6
Suggested List Price	**$199.95**	**$495.00**	**$450.00**	**$495.00**	**$565.00**

Time tests were performed on an Acer 286 (8 MHz), 640K RAM. [1] File size 103K. [2] 1636 lines. [3] 14 occurrences. Times shown are in seconds. (Benchmark details available upon request.)

Prices and specifications subject to change without notice.

*Customer satisfaction is our main concern; if within 60 days of purchase this product does not perform in accordance with our claims, call our customer service department, and we will arrange a refund.

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BORLAND
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CIRCLE 377 ON READER SERVICE CARD

STI 88-10

Standard Features:

- Intel 8088-1 CPU
- 512K Memory 120NS, Expandable to 1MB
- Dual Speed 4.77/10 MHZ
- Landmark 4 1 MHZ
- 150WT UL Power Supply
- Eight Expansion Slots
- One 360K Floppy Drive
- 1 Parallel, 1 Serial, 1 Game, Clock
- 84 Key Tactile/Feel Keyboard
- 8088 Turbo Case
- Operations Manual
- One Year Warranty

MONO SYSTEM	**$ 645**
RGB SYSTEM	**$ 819**
EGA SYSTEM	**$1030**

HARD OPTIONS:

20MB	**$259**
30MB	**$295**

STI 286-10

Standard Features:

- 512K Memory 100NS, Expandable to 1MB
- Dual Speed 6/10 MHZ, 0 Wait State
- Landmark 12 MHZ
- 200WT UL Power Supply
- Eight Expansion Slots
- One 1 2MB Floppy Drive
- Dual Floppy and Hard Disk Controller
- 1 Parallel, 2 Serials, Real Time Clock, Game Port
- Enhanced 101-Key with Tactile/Click Keyboard
- 286 Turbo Case
- Operations Manual
- One Year Warranty

$$ See Price Table $$

STI 386 TOWER

Standard Features:

- Intel 80386 CPU, 32 BIT Architecture
- 1MB RAM 80NS, Expandable to 2MB
- 16 MHZ (Landmark 20 MHZ)
- 20 MHZ (Landmark 25 MHZ)
- Five 16 BIT Slots, Two 8 BIT Slots
- One 32 BIT Memory Slot, Up to 10MB
- 8 or 10 MHZ 80287 CO-PROCESSOR Socket
- Real Time Clock, 80387 Adapter Board as an Option
- 200WT UL Power Supply (Tower System 250WT)
- Enhanced 101-Key with Tactile/Click Keyboard
- Dual Floppy/Hard Disk Controller
- One 1 2 Floppy Drive
- One Parallel, Two Serial Ports, Game Port
- One Year Warranty, Operations Manual

$$ See Price Table $$

STI 286-12

Standard Features:

- 512K Memory 80NS, Expandable to 1MB
- Dual Speed 6/12 MHZ, 0 Wait State
- Landmark 16 MHZ
- 200WT UL Power Supply
- Eight Expansion Slots
- One 1 2MB Floppy Drive
- Dual Floppy and Hard Disk Controller
- 1 Parallel, 2 Serials, Real Time Clock, Game Port
- Enhanced 101 Key with Tactile/Click Keyboard
- 286 Turbo Case
- Operations Manual
- One Year Warranty

$$ See Price Table $$

30 DAYS SATISFACTION GUARANTEED

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SYSTEM PRICE TABLE

	286-10	286-12	386-16
MONO SYSTEM WITH 12" MONITOR	$1020	1120	1985
MONO SYSTEM WITH 15" FLAT SCREEN	$1080	1180	2045
RGB SYSTEM WITH 14" MONITOR	$1190	1290	N/A
EGA SYSTEM WITH 14" MONITOR	$1405	1505	2400
VGA SYSTEM WITH 14" MONITOR	$1630	1730	2695
MULTI-FREQ. SYSTEM 14" MONITOR	$1645	1745	2720

STI 386 Options Available:

80387 Adapter Board	$ 85
20 MHZ Option	$250
Tower Case/250W Power	$200

MONITORS

SAMSUNG, AMBER, 12", TTL SWIVEL BASE, 720 x 350, 80 x 25	$ 75
TATUNG GM-1495, 14" MULTI-FREQ 800 x 560, TILT/SWIVEL	520

QUIMAX

DM-14, HIGH RES, MONOCHROME MONITOR 14", 750 x 350, 152 COLUMNS x 44 LINES	118
DM 15, 15" AMBER FLAT, 750 x 550 1000 LINES	155
DM-1502, RGB 640 x 240, 14"	250
DM-2214, EGA MONITOR 720 x 550, 64 COLORS	560
DM-3112, 12" VGA, 480 x 720	360
DM-5114, 14" VGA, 480 x 720	445

HARD DISKS

ST-125 40MS	$525
ST-225 20MB 65MS	210
ST-225/KIT 20MB	259
ST-238 30MB 65MS	236
ST 238/KIT 30MB	295
ST 4096 80MB 28MS	650
ST-251 40MB 40MS	570
ST-251 40MB 28MS	455

FLOPPY DRIVES

TEAC 360K	$ 82
TEAC 720K	98
TEAC 1 2M	98
TEAC 1 44M	120
MITSUMI 360K	75
MITSUMI 720K	89
MITSUMI 1.2M	89
MITSUMI 1 44M	110

Z-NIX MOUSE

HI RES MOUSE W/TURBO CAD	$105
BUS MOUSE	50
SERIAL MOUSE	40
BUS MOUSE W/PC PAINTBRUSH OR DR HALO III	66
SERIAL MOUSE W/PC PAINTBRUSH OR DR HALO III	56
DR HALO III	25
PC PAINTBRUSH	25
TURBO CAD	45

MODEMS

EVEREX 1200 INTERNAL	$ 80
EVEREX 2400 INTERNAL	155

KEYBOARD

5060 STYLE KEYBOARD 84 KEYS, LARGE RETURN KEY 5 LED INDICATORS	$ 45
5161 STYLE KEYBOARD TACTILE/CLICK, 101 KEYS, 12F KEYS, SEPARATE NUM & KEYPADS	57
KEYTRONIC 101 KEYS	55

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Sat. 10 a.m.-5 p.m.

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Fax: (213) 605-5032
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- Shipping charges will be deducted from any credits or refunds
- All items returned to us must include original documentation and package
- Authorized returns must be sent shipping prepaid, with RMA number
- All basic systems carry a comprehensive 12 month parts and labor warranty.
- All individual parts carry a 90 day warranty from us
- Any additional warranties are covered by manufacturers.
- All prices and specifications are subject to change without notice
- No surcharge on credit card orders

VISA MasterCard

Corporate 1000 and University PO's Welcome!

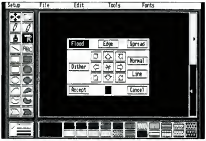
CIRCLE 738 ON READER SERVICE CARD

PC UPDATE

by Paula Seefeldt

Grasp 3.1 Uses Macro Definition

Paul Mace Software has added a macro-definition capability to *Grasp*, "the Graphics Animation System for Professionals." *Grasp*, Version 3.1, allows sequences of commands to be predefined and variables to be passed at run-time. Pictor, the accompanying painting program, uses new blending techniques and custom color mixing in RGB or process colors. Updates are available for $35, and new packages retail for $149. Paul Mace Software, Ashland, Oreg.; (503) 488-2322.



Pictor adds new blending techniques to Grasp *3.1.*

Kinetic Graphics Adds Image Libraries

Kinetic Presentations has added two software disks to the ***Kinetic Graphics System.*** The Symbols Library uses presentation graphics files that may be used and edited within the accompanying Kinetic Art. The Standard Image Library is a .CGM (computer graphics metafile) file of 79 full-color images that works within both Kinetic Art and Kinetic Layout. Upgrades to Version 1.20G are available for $20. New packages retail for $995. Kinetic Presentations Inc., Louisville, Ky.; (502) 583-1679.

OS/2 for Mach 20, Excel Guarantee

Microsoft Corp. is shipping an adaptation of **MS-OS/2 for Mach 20,** part of the Microsoft Mach 20 Performance Enhancement System. New features include a task-switching clock, reset capability, and a larger address bus. MS-OS/2 for Mach 20 retails for $325. . . . ***Microsoft MS-DOS CD-ROM Extension,*** Version 2.0, reads disks pressed in ISO 9660, as well as in the High Sierra file format. Version 2.0, which also supports the Japanese Kanji character set and integrates audio data with text and graphics, is available for $50. . . . For spreadsheet users who are waiting to evaluate upcoming releases of ***Lotus 1-2-3*** before purchasing a new package, Microsoft offers its "Win-Win Guarantee." ***Microsoft Excel*** users who are dissatisfied with the package may return *Excel* and receive a full refund through January 1, 1990. Microsoft Corp., Redmond, Wash.; (206) 882-8080.

Lotus Manuscript 2.0 Works with Bitstream Fonts

Lotus Manuscript now links spreadsheet data to *Manuscript* documents. Version 2.0 also offers a 220,000-word thesaurus. Upgrades are $75 to registered users who purchased Version 1.0 before December 1, 1987. All other registered users will receive the upgrade free of charge. New packages are $495. Lotus Development Corp., Cambridge, Mass.; (617) 577-8500 . . . . Bitstream has released the ***Fontware Installation Kit*** for *Manuscript* 2.0. This kit enables *Manuscript* users to generate downloadable fonts from any Bitstream *Fontware* typeface package. The *Fontware Installation Kit* is $95, and *Fontware* typeface packages are $195. Bitstream Inc., Cambridge, Mass.; (617) 497-6222.

Finest Hour 3.0 Offers Craft-Loading Report

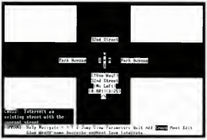
Finest Hour, from Primavera Systems, now uses a craft-loading report to analyze assignments in a bar chart format. Version 3.0 also has alphanumeric identifiers to filter information, and a master project summary capability. Upgrades were sent free to all registered users. New packages are $5,000. Primavera Systems Inc., Bala Cynwyd, Pa.; (215) 667-8600.

AdaptSNA 3270 Cuts Cost By 58 Percent

NSA has reduced the price of its ***AdaptSNA 3270*** emulation software by 58 percent and added several new features. *AdaptSNA 3270* now includes script language for unattended file transfers and full-color support. The new price is $245. Network Software Associates Inc., Laguna Hills, Calif.; (714) 768-4013.

Street Smart Designs Bigger and Better Maps

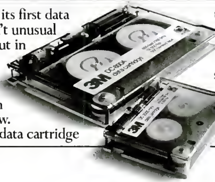
Street Smart, the routing package from Street Smart Software, can now use word processing programs to create maps. For faster map building, a Digitizer Option is available. Version 3.0 also builds larger maps and uses color graphics. Upgrades are $260 for 1.0 users and $110 for 2.0 users. New packages retail for $349. The Digitizer option is an additional $299. Street Map Software, Schaumburg, Ill.; (312) 529-4044.



CROSS Intersect an existing street with the current street

Street Smart *3.0 increases speed for quicker, easier maps.*

To create the world's first data cartridge tape, our engineers had to give up a lot of dreams.



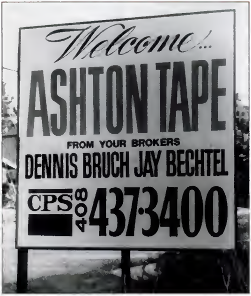
To bring the world its first data cartridge tape, it wasn't unusual for our engineers to put in a little overtime on their overtime. Or occasionally miss the late show. Or even miss the late, late show.

And even after the data cartridge tape was born, they still refused to lay low. It had to be perfected.

So, instead of counting sheep, our engineers counted patents. In fact, over ten of them are in use today. A number no other data cartridge tape manufacturer

COMMUNIQUÉS

by Bill Howard



Of course, it all happened so fast, we didn't really get to know the buyer . . . .Ed Esperb, Ned Expert, something like that, I think he said his name was. But after they move in, we'll sure be by to say howdy, neighbor. (Realtor's sign, Los Gatos, Calif.)

Amazing Facts I

"There is one arena in which IBM did not try to maintain operating system hegemony—the 1980s decentralized world of personal computing. MS-DOS and PS/2 are built by Redmond, Wash.-based Microsoft Corp."

—Information Week, *June 13, 1988*

Amazing Facts II

"Dell [Computer] claims that its System 500, a 386-based Model 80 clone, will have a performance rating equivalent to that of an IBM AT compatible."

—Computer & Software News, *June 6, 1988*

Amazing Facts III

"The VAX-MATE is a prototypical answer to DTP requirements. Like the Apple Macintosh or IBM PC-based units, it's based on an MS-DOS personal computer."

—DEC Professional, *October 1987*

Amazing Facts IV

"The [PS/2 Model 50 Z] memory chips operate at 85 billionths of a second. That difference makes the machine up to 35 percent faster than its predecessor, a 30-megabyte diskette."

—Popular Science, *August 1988*

Amazing Facts V

"One well-known virus which turned up at Lehigh University hides in a program used by IBM-compatible computers called 'COMMAND.COM.' Many programs require that this program be readily available in order for them to run."

—Milwaukee Sentinel, *June 21, 1988*

Illustration Richard Tennant

Official Language Of Bonneville Salt Flats

"The up side is that a program written in Assembly will run at least a hundred times faster than anything else. The down side is that it will take a hundred times longer to write it."

—On Computers newspaper column by Bob Schwabach, The Kansas City Times, *June 17, 1988*

Maybe It Was Written in Assembler . . .

"The MemoryMate is what is known as a 'flat file' data base. This means that every single word in the file is indexed. That is how it is able to find information so fast."

—The Office *magazine, May 1988*

. . . Or Was It High-Speed BASIC?

"All [NCR point-of-sale terminal] models work from BASIC, a computer language designed especially for high-speed transaction processing."

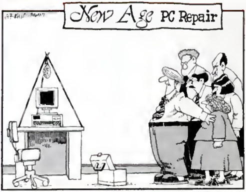
—Entrepreneur *magazine, July 1988*

Mea Culpa

PC Magazine makes fun of everyone else's mistakes. So when we slip up, we're fair game, too:

"When a PC . . . is booted, the BIOS initializes the hardware to character mode 3: 80 columns wide and 25 rows high. Thus a maximum of 4,000 (80 * 25) characters can be displayed on the screen at once . . ."

—PC Tutor, June 28, 1988



"Quiet everyone—let the crystal do its work."

Have you seen anything offbeat, unusual, or just plain dumb about the computer industry? If so, send your submissions to Communiqués, PC Magazine, *One Park Avenue, New York, NY 10016. Please print your name legibly; include the name, city, and publication date of any newspaper or magazine clipping, and include your T-shirt size. Contributors will receive $50 and a* PC Magazine *T-shirt. In case we receive duplicate entries, the earliest postmark will prevail. Sorry, but unused entries cannot be acknowledged.*

*Winners for this issue: Dan Holem (Ashton-Tape), Michael Haynes (Assembly), Vicky Fling (flat file), Joseph Pescatello (high-speed BASIC), Dave Aton (Microsoft PS/2), David Gradin (Dell Computer's System 500), Gray Rober (VAX-MATE), Michael Pittelkow (30-megabyte diskette), Bruce Kurkiewicz (virus), Payne Freret (80*25=4,000).*

1

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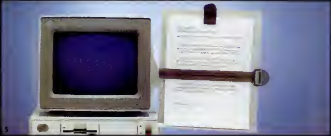

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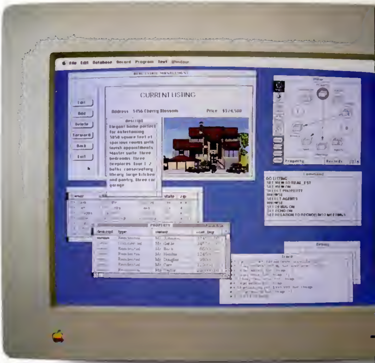

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■ **BILL MACHRONE**

INTEGRATED SOFTWARE RIDES AGAIN

Integrated software met with barely stifled yawns 3 years ago. Now it's the hottest thing around. IBM's even giving it away with the Model 25. What happened?

Back in 1985, *PC Magazine* ran a cover story pitting *Symphony* against *Framework*. In this first-ever showdown of integrated software products, we lauded *Framework*'s word processing capabilities and applauded *Symphony*'s spreadsheet. In the ensuing years we've looked at *Smart*, *Enable*, *Electric Desk*, and many others. All the while, however, we had the sense that we were boring people to tears.

Lotus, for one, has taken an incredible amount of grief over *Symphony*. It's too much like *Lotus 1-2-3*. It's not enough like *1-2-3*. It's too spreadsheet oriented. There's too much mainframe emphasis. The mainframe connection isn't powerful enough. And so on. When *Symphony* was introduced, Lotus and everyone else expected it to be bigger than *1-2-3*. Its languid sales were a surprise to all concerned.

To be fair, *Symphony* has been a slow burner. Lotus points out, somewhat defensively, that if *Symphony* were a separate business it would be the tenth-largest software company. Much of this growth, however, came late in the game, and it is typical of what's happening to integrated software.

RENEWED INTEREST Today *Symphony* sells well, although it still stands very much in the shadow of the venerable *1-2-3*. Ashton-Tate has shipped *Framework III*. *Smart* and *Enable* have their own battle going in the LAN market, while *Alphaworks*, *PFS:First Choice*, and others slug it out in the low end. Meanwhile, IBM is bundling *Microsoft Works* with the Model 25. What's going on here?

First, the market is much larger than it was 3 years ago. Time was when everyone was a power user. You had to be, just to get anything done. Everyone I knew was forever writing programs to convert one word processor's format into another, or to modify files so they'd be acceptable for modem transmission. The technical columns of *PC Magazine* still deal with these topics, but chances are you're doing those conversions for someone else—your clientele—and not just for yourself.

That clientele has grown enormously over the past several years. And though the early adopter's needs have been satisfied—namely, "Get me anything, so long as it works"—the current crop of users are far more picky about what they'll put up with. Whether you work in the infocenter, MIS, or an end-user department, or if you're a VAR, or just a highly knowledgeable user who makes lots of recommendations to others, you have to face this reality. It's taken many of us a surprisingly long time to learn that what works for us won't necessarily work for everyone else.

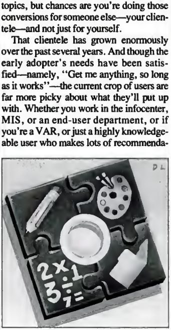
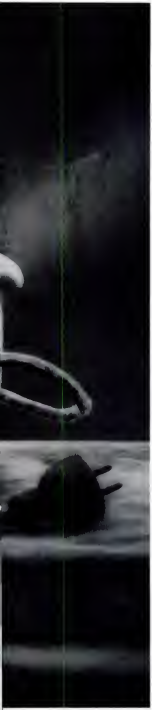


Illustration: Darryl Ligasan

Take *PC Magazine*, for example. Text editing is the lifeblood of the editorial department. Almost everyone uses *XyWrite III Plus;* several people use *WordPerfect;* a few use *WordStar*. Oh, yeah—John Dickinson uses *Microsoft Word*. Changing word processors is not something one does lightly, which is the primary reason that *WordPerfect* and *WordStar* users have stuck with what they know. Dickinson has an excuse: he cowrote a book about *Word*.

These are proper tools for heads-down text editing and creation. Virtually no one on the editorial side uses integrated software. Our sales and marketing staff, however, use integrated software almost exclusively. Through a not-so-simple twist of fate, they use *Enable*, *PFS:First Choice*, and *Microsoft Works*. One or two of the marketing staff do use *Microsoft Word*. Dickinson must have given it to them.

FACTIONS ABOUND One group mocks another's use of "Unable." Others have to live with being users of "Quirks." And, yes, you guessed the final pun: "Last Choice." The bottom line, however, is that the work gets done, usually to everyone's satisfaction. The *Enable* people enjoy the relative ease with which it slips from graphics to text and back. The *Works* people gloat over their spreadsheet power, which arguably outmuscles *1-2-3*. And everyone else is envious of *First Choice*'s straightforward command structure—just



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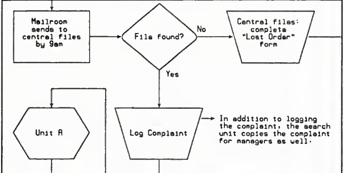
Mailroom sends to central files by 9am
File found?
No
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Log Complaint
In addition to logging the complaint, the search unit copies the complaint for managers as well.

the ticket for the occasional user.

Integrated software is the current right answer to the disparate needs of new users. It's not for everybody. People with power applications still need standalone word processors, databases, spreadsheets, graphics, and communications packages. Many products in these categories have vibrant aftermarkets, such as those that have sprung up around *1-2-3* and *dBASE III*. These third-party offerings potentiate the utility of the products—for the right user.

DEATH THROES? It's clear from the sheer number of integrated products that something important is going on here, quite apart from my initial suspicion that we were witnessing a thrashing—a kind of living death—of the DOS market, as the same old features were endlessly rehashed and repackaged and remarketed.

Instead we're seeing integrated products with real reasons to be different, real strengths (and weaknesses), and real markets to pursue. You can't mention all the integrated packages in one breath, much less tar them with the same brush. *Alphaworks* and *Framework III* are drastically different in conception, as are *Symphony* and *Smart*. Some, like *Framework* and *Enable*, are dynamite development environments. *Alphaworks, PFS:First Choice*, and *Microsoft Works* make no claim to programmability or extensibility, but each has a strong reason to be slugging it out in the market. Which one has the best hooks into *dBASE* files? Lotus worksheets? Which one's modules stand alone as easily as they work together? Which one has the best multiple simultaneous access of its database records over a LAN? Got the answers on the tip of your tongue? You'd better if you're going to serve your clientele as well as they deserve.

Oh, and what about IBM bundling *Microsoft Works* with the Model 25? Is offering great software the way to persuade people to buy a lackluster machine? No, but there's a rightness to this combination that transcends casual observation. The Model 25's all-in-one design virtually begs for the all-in-one capabilities of a package like *Works*.

The combination is a paradigm for integrated software: the synergy is the sizzle. PC

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DATA EASE 2.5r3	EXCELLENT	EXCELLENT	GOOD	SATISFACTORY	VERY GOOD	EXCELLENT	GOOD	EXCELLENT	7.8
DATAFLEX 2.3	EXCELLENT	EXCELLENT	VERY GOOD	GOOD	VERY GOOD	SATISFACTORY	UNACCEPTABLE	GOOD	6.6
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■ JOHN C. DVORAK

CANADA, O CANADA

They may look like Americans and even talk (almost) like Americans, but Canadians don't share all our attitudes and ethics, especially when it comes to bootlegging software.

Before the end of the year we'll know if Canada is serious about lifting import trade barriers for products from the United States. It's assumed that the American government will gladly lift import barriers for Canadian exports. Free trade at last. Not a moment too soon for the hapless Canadian, who pays too much for software, too much for hardware, and, well, too much for technology in general. Or so it seems.

A recent *PC Magazine* Editors' Day in Toronto revealed to me that Canadians are in dire need of relief. Their isolation does their country no good. The editors decided that these northern neighbors are at least 18 months behind the current trends in personal computing. My observation was that they were 4 years behind, an assertion I maintain.

CORRUPTION OF A CULTURE? Paranoid Canadian nationalists fear, with some justification, that opening the border to the frenzied American salesman will bury Canada in American goods. Worse, they fear that the delicate Canadian culture will be damaged and Americanized. Heaven forbid! Since the culture of south Alabama (let alone most other parts of the South) hasn't been Americanized over the past 200 years, I doubt that Canada will be affected.

In dealing with Canadians we always have to remember that Canadians aren't Americans, although they dress much the same and talk somewhat the way we do. They're still Canadian.

I've always been fascinated by Canadians and their strange culture. They are far more European in their ideas and attitudes than we are. For one thing, they don't complain as much as Americans do. This undoubtedly stems from the Colonial days. The Canadians never fought a revolution. The group up there was perfectly happy with Mother England. In fact, there always seemed to be a reluctance to loosen ties with Great Britain.

THE FRENCH CONNECTION Add to this the influence of the French Canadians. In Canada you hear everything twice because everything, by law, has to be done in English *and* French. I suspect that because of this background our Canadian neighbors will not be susceptible to the same sales pitches that work so well with the American audience. Perhaps we'll be more effective if we repeat ourselves. Repeat ourselves.

While Canadians seemingly respect law much more than Americans do—as the low crime rate in Canada indicates—they also have some unwritten cultural laws that are completely foreign to us down here in the States. When it comes to bootlegging computer software, for example, the word is *scofflaw*.

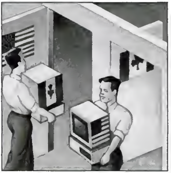

Illustration: Darryl Ligasan

It's really no coincidence that Quaid Software Ltd., a Canadian software firm, makes some of the best de-copy-protect software available today. Quaid was the target of the recent Vault suit (eventually lost by Vault). There is nothing illegal about the Quaid software, of course, but in Canada it's routinely used for more than mere backing up.

It was also in Canada that the notorious software rental library existed. For $15 you could rent a copy of everything from *dBASE III* to *Lotus 1-2-3*. It was a bootleg operation just like one you might find in Taiwan. Canada is also known for bootleg ROMs running in PC clones. Nobody bothers with the Phoenix or the Award BIOS chips. They just use copies of the original.

A PLEASANT FOLK Canadians are very pleasant and somewhat gentle (except during a hockey game), and perhaps this exchange of illegal copies is a reflection of helpfulness.

Like I said, Canadians aren't Americans. Their ethics and their attitudes are quite different from our own. So who knows what free trade will bring? While American firms think they'll clean up in Canada, they may instead find themselves cleaned out.

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■ **JOHN C. DVORAK**

INSIDE TRACK

Plugging portables and the reason why; paging through Pravda on CD-ROM; a dandy demo disk.

There's a **peculiar phenomenon** in the microcomputer arena whereby minor trends are **blown out of proportion** because certain products appeal directly to the technology writers themselves.

For example, the hoopla years back over the original Radio Shack/Tandy Model 100 laptop computer was the direct result of a bunch of reporters and writers who needed such a product. You'd think everyone in the world would want one, the way these guys talked it up. Personally, I could never use the thing and it wasn't until the Zenith Z-181 came along that I even felt comfortable with a portable. Then came the 286 SupersPort—an **incredible machine,** except for the fact that it weighs 13 pounds.

The irony of the 13-pound-bowling-ball Zenith machine is that it gave me some appreciation for the barely usable but feather-light (if feathers weigh 6 pounds), **inexpensive Toshiba T1000.** I find the T1000 **impossible** to use in dim light because of its smallish, non back lit display and mediocre contrast. But when the sun is out, it's very usable and easy to live with. The keyboard is excellent too. I now use it for quick overnight trips and reserve the Zenith for serious jaunts or when I need some **real** computer power. Life is easier when you have a wheeled cart for the computer and your bags. These are **the only two portables worth considering** as far as I'm concerned.

See how easy it is for a writer to go on and on about something like portables? Then again, who better knows what should be in a portable than a writer who uses one? Curiously, I know **no writer** who has ever been asked by a laptop vendor about what writers need in the way of a laptop. **No wonder** the perfect machine hasn't arrived on the market.

This brings me to another writers' desire: access to **unlimited information.** Writers are the big boosters of CD-ROMs because they know that tons of source material will be put on them. Volumes of research will be available inexpensively on small disks. Someday. Yeah, right.

So what do we **get?** Public-domain software. That is, until now. The most interesting disk (so far) just arrived. It is, of all things, ***Pravda* on-disk.** The vendor is not the KGB, but Alde Publishing (4830 W. 77th St., Minneapolis, MN 55435; (612) 835-5240). For $249 you get all the 1987 issues of the English edition of the Russian newspaper *Pravda*, fully indexed and easy to access. **I'm amused** that this disk became available before anything from the *St. Louis-Post Dispatch*, from *The New York Times*, or even from the technophiles at Dow-Jones. What gives? To read *Pravda* all you need is a drive and the CD-ROM DOS extensions from Microsoft.

Alde publishes eight CD-ROM disks including the ubiquitous public-domain library of IBM PC software. One to know about is a **U.S. Procurement** disk containing Title 41/48 CFR and the GSA supply catalog. It's $199.

The Heck with Networks Dept.: I recently received an ASCII document on an IBM diskette and wanted to run it through my Macintosh to improve the output with some **hot PostScript** typeset action. I didn't have the right screwball Mac connector to get a modem to work and didn't want to deal with TOPS or any other network. I wanted an easy way to move the data. What to do, what to do? **Helloooo Central Point Software** and the nifty add-in board—the Deluxe PC Option Card. It turns your 3½-inch drive into a Mac-compatible drive. With some nifty software you can now take an IBM file and move it over to the Mac disk and then use it on the Mac. For $159.95, **it's hard to beat,** especially since it adds interesting backup capabilities to normal floppy disk operation. Call for information (Central Point Software, 15220 N.W. Greenbrier Pkwy., #200, Beaverton, OR 97006; (503) 690-8090).

Genuinely Interesting Demo Disk Dept.: I never thought I'd write about a demo disk that impressed me. You've seen a million of them. Always the same. Hackneyed self-running computer demos of various programs interspersed with text on why the system is so great. You most often get that pink-and-yellow demo that blinds you with **bad taste and ugly colors.** Much of the problem stems from the insistence on using the CGA as the display. **Folks, the CGA is *dead!*** Let's shoot anyone who uses or writes software for it.

OK, the demo disk that impressed me is called *The Adventures of Ferguson Floppy* from **Paul Mace Software** (400 Williamson Way, Ashland, OR 97520; (503) 488-2322). Mace, who recently announced still another antivirus package, is best known for his excellent *Mace Utilities*. He may soon be best known for the best demo disk. Call the company and cajole it out of a copy; pay it whatever it wants (not to exceed $10). The demo requires an EGA, by the way.

Plugging Myself Dept.: If you're bored some night, call CompuServe and try **PC MagNet.** Go into the columnists section and then into the Dvorak section and contribute your views and ideas into the **bubbling controversies.** Pass along something worthwhile and you'll get mentioned in the column. Walter Dnes told the world about the new **merger between Lotus and Ashton-Tate.** The new company will be **renamed L/ATE.** Don't let it happen to you!

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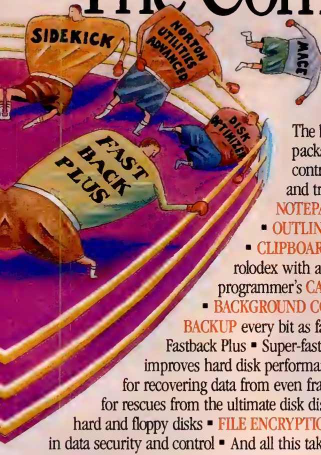

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■ JIM SEYMOUR

DOS 4.0: LESSONS ON PC INTERFACES

Sure, DOS 4.0 has some nice things to offer. But in the great Interface War, its cute visual shell does not provide the enduring fix the operating system needs to come out ahead.

Microsoft's shipment of DOS 4.0 to its hardware-vendor licensees, and those licensees' shipment of it with their products, brings up some questions not yet addressed about the nature of PC software interfaces.

First, the good stuff: Quite apart from the optional visual shell in DOS 4.0, which has been getting all the attention, this new release of the operating system PC users love to hate offers some nice touches.

For one thing, the new DOS allows the creation of hard-disk partitions larger than the 32MB limit of earlier DOS versions. Nice, but not sensational; we've been able to do that with utilities—many of them provided free by the vendors of large hard disks—for more than 2 years. And I wonder if dividing a huge hard disk into 32MB partitions isn't a better way of managing that space than using it as one huge drawer. To each his own.

A second new feature allows DOS 4.0 to access the Lotus/Intel/Microsoft expanded memory specification, Version 4.0 (known as EMS 4.0 to its friends). This lets DOS stash things, such as the device drivers listed in your CONFIG.SYS files, the memory you allocate for FILES and BUFFERS in your CONFIG.SYS file statements, and the ever-present COMMAND.COM, in expanded memory, thereby clearing out a little more of that precious 640K of conventional PC memory for application programs.

(But note that DOS 4.0 does *not* let applications not yet rewritten for EMS 4.0 do end runs into that expanded memory: there is no free lunch. You'll still have to buy EMS 4.0–aware releases of your software—if they exist.)

Nice as those features are, they're not getting the attention that DOS 4.0's visual shell has drawn. I'm not in love with the 4.0 shell; what I think it really shows is that there will still be a lively market for DOS shells from third-party vendors.

While Microsoft's shell is OK for people coming into the PC-DOS/MS-DOS world—and is thus a boon to makers of such entry-level PCs as the Vendex, Blue Chip, Epson Apex, and Amstrad boxes—it's not nearly as useful as the better DOS shells from other vendors. *Pathminder, X-Tree,* and *Q-DOS* are far more capable than the Microsoft DOS 4.0 shell. If I worked for the publishers of any of those three shells (as well as some others), I wouldn't be worried . . . yet. Because what the visual shell bundled with DOS 4.0 really points out is how far behind system-software-level interfaces are falling and that an enduring fix involves a lot more than cute shells.

Illustration: Daryl Ligasan

INTERFACE WAR We are now roaring into a bloody Interface War in computers—I intentionally avoid saying *personal* computers—and in that race, DOS lags further and further behind.

Microsoft Windows, whether it survives the Presentation Manager Era or not, is still about half of a real graphical interface. Half-finished interfaces are nothing new in this business—*Lotus Express* is a grand example of a job still waiting for the crew to come back from lunch—but *Windows* is particularly aggravating because it is so often held up as a paradigm of where we're headed.

Don't you love the idea of lists of filenames . . . in a "graphical" interface?

Phooey. *Windows,* and especially *Windows/386,* feels like iteration number 3 on a list where the product becomes useful and important somewhere around iteration number 7. Frankly, if it weren't for *PC PageMaker, PC Excel,* and the Micrografx products, who'd use *Windows*?

If *Windows* is about half of an interface, Hewlett-Packard's *New Wave,* which sits atop *Windows,* is a large part of the remaining chunk. But *New Wave* is still far from market, it is under legal attack by Apple (which ought to be afraid, since *New Wave* shows much of what's wrong with the Mac's *MultiFinder*), and it is—forgive me—marketed by HP. Which does not augur well for a vigorous, high-profile marketing push, does it?

The rest? If AT&T and Sun can get

■ JIM SEYMOUR

Open Look together reasonably soon, it may grab a sizable chunk of the Unix market and it may somewhat increase Unix's incursions onto DOS's turf. *Open Look* is a very nice program, but at this point it is like the ultimate extension of *Dan Bricklin's Demo Program:* a tool for showing what a tool might look like someday if it ever gets written. AT&T's potential partners trooped off to New Jersey to see about adopting *Open Look* but came back empty-handed.

And there's Apple's *MultiFinder* for the Macintosh. It's a very good start, but even Apple knows *MultiFinder* isn't enough and is rewriting the entire program from the ground up.

Dear Mac owners: Look for operating-system/interface news from Big Red in another couple of years. Until that time, put up with *MultiFinder*'s quirks and run all of your important programs under plain ol' *Finder*.

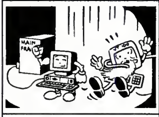
> ■ While Microsoft's visual shell is OK for people coming into the PC-DOS/MS-DOS world, it's not nearly as useful as the better DOS shells from other vendors.

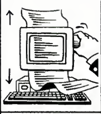
I have, you will notice, largely ignored the Presentation Manager.

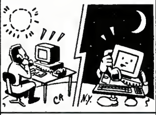
It's easy to ignore something that doesn't yet exist, but it won't be for very much longer. Substantial momentum is now building in the personal computer applications-software business to support PM early and well. Over the past year we've gone from early giddiness about OS/2 and PM, to dismay over the design problems in OS/2, to a growing, if grudging, acceptance among PC software developers and publishers that either they'll support OS/2 in a substantial way or they'll be closing the doors.

The Presentation Manager is still far from an optimal, even complete, interface. It uses too much of *Windows*' half-graphical style to escape that curse. And it carries forward the clumsy accommodation of character-based displays, in IBM's SAA style.

The visual shell in DOS 4.0 doesn't threaten the future of DOS-shell vendors. But it does show that companies ostensibly committed to better, graphically based interfaces still choke at the moment of truth.







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■ STEPHEN MANES

USER INTERFACES: PLUMBING THE DEPTHS

Will user interfaces ever begin to adhere to some sort of coherent standard? You'll find the answer in rental cars and hotel bedrooms and bathrooms.

Cruise the exhibit hall of any convention in which software is displayed and you'll find almost as many user interfaces as products. Each and every vendor will puff with great pride over his or her software's uniquely dumb look and feel.

You know: "All you have to do to find the author of a monograph is type 'au' in lowercase, an equals sign, and then the author's name in caps. You can even use wildcards: just enter a caret for any single letter, or an ampersand for an incomplete entry. If you forget, you can just tap Alt-F6 for help. Our users think it's just great."

Or: "Gosh, no, our Left and Right Arrow keys won't let you move between the drop-down menus. We tried that, but our users just found it too confusing."

Or: "When the menus just popped down, they seemed a little too startling. So we developed this little 'windowshade' effect and 'roll-down' windows. Our users think they're swell."

Ignore for the moment the fact that "our users" generally means the programmer, the programmer's spousal equivalent, and the boss. Why is it that everyone in computerdom insists on reinventing the user interface?

STANDARD MOUSETRAPS Because everyone everywhere keeps reinventing *every* user interface, that's why. Ten minutes after users finally master the standard mousetrap, some novice cheesemonger invariably comes up with an "improvement." Often it's not better, just different, but for a variety of reasons—everything from cheapness to cuteness—it manages to catch on.

Proponents of the idea of software standardization always cite the automobile, pointing out that you can get into any car anywhere in the world and drive it instantly. Which is true—unless, of course, you happen to get in on the wrong side, which you will if you visit a country that does not share driving-side conventions with yours.

If you can't always tell which side of the road to drive on, how can you expect conformity in lesser matters—say, getting the key out of the ignition? A few cars let you simply yank it out. Others require a tap or a yank on a sometimes-hidden button. Some demand that you push the key into the lock and give it a special twist. When the secret instruction decal wears off the steering post of a rental jalopy, the guesswork is up to you.

Or—quick!—how do you turn on the windshield wipers? Rotate the turn-signal stalk? Push down on another stalk? Reach for a knob on the dashboard? Every car does it differently. At this moment, some designer is undoubtedly arguing that you should poke an animated windshield wiper icon on a touch-screen and adjust the speed by jabbing at thundercloud icons.

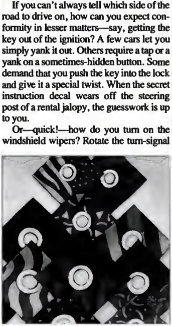

Illustration: Darryl Ligasan

A few years ago, the headlight dimmer switch was always beneath the driver's left foot. Today, it's almost always on the turn-signal stalk—except when there's a separate light stalk. Is this an improvement? Not when you want to keep both hands on the wheel on the dark and winding roads where you're most likely to use your brights.

WAKE-UP CALL Next time you're in a hotel room, check out the user interface on the clock radio. To set the alarm, you may have to fiddle with two buttons marked "fast" and "slow." To activate the alarm, you'll probably have to flip a lever to "buzzer" or "auto." If you choose the latter, you'll have to flip back to "radio" first to make sure you've set a station with the volume loud enough to blast through your slumbers. The endless variants are just confounding enough to send you to the phone to order a wake-up call—a process which, of course, differs from inn to inn.

The controls—remote and built-in—for my new stereo receiver are set up so stupidly that I generally press two wrong buttons for every right one. Naturally, the product won an industry award for clarity. We will not discuss the operation of VCRs except to note that their ever-changing user interfaces seem to come a long, long way

■ **STEPHEN MANES**

every year—and always seem to have a long, long way to go.

And awful designs often become firmly entrenched. Take plumbing: a short tour of Old World fixtures should convince you that standard interfaces will arrive only through the imposition of totalitarian government—and perhaps not even then. The variety of Bad Ideas encompasses everything from the classic hole-in-the-floor toilet to the high-tech Swiss hand-washing machine (stick hands underneath, and metered doses of liquid soap, rinse water, and hot air emerge in succession)—everything from the sit-down bathtub that won't let you stand up to the all-in-one bathroom whose every surface becomes damp the instant you turn on the shower. But American fixtures are hardly consistent, either: you don't dare adjust a hotel shower with soap in your eyes.

Even genuine standards end up being adapted, modified, bent out of shape. I'll bet not one American in a thousand can fathom certain arcane examples of the supposedly simple icon-based international road signs. What's a red circle with nothing but white in the middle of it—and an explanatory sign below it in a language you don't happen to know? My wrong answer got me an interesting drive through Lucerne's major pedestrian mall at high noon.

JUNGIAN ARCHETYPES The lesson is clear. If we can't standardize on the user interfaces for such relatively simple items as cars, showers, and toilets, it's irrational to expect some sort of Jungian drive toward archetypal computer hardware and software. We've seen it already, and we'll see it again: just when everybody begins to agree on something—keyboard, screen setup, you name it—some mad genius or corporate giant will come up with a "slightly better" idea that makes just enough of a dent to muddy the waters. Result: the standard changes.

There seems to be a basic need for user-interface change even when underlying technical standards remain stagnant. We're still stuck with the color TV system we've had for over 30 years, but TV set controls now do everything but play the zither. DOS may be firmly entrenched, but the face it presents to the world seems to change daily. Even Macintosh software developers are beginning to rebel against some of the obvious stupidities of Apple's once-sacred desktop.

So by the time you figure out current user interfaces, you can reasonably expect to have to confront a whole set of new ones. F1 or point-and-click for help? Forget it: I've cornered the market on those old headlight-dimmer foot switches. PC

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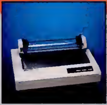

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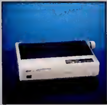

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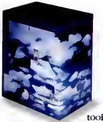

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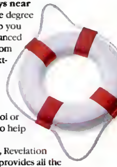

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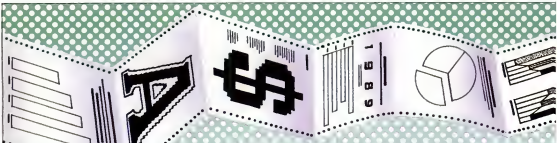

THE 5TH ANNUAL ALL-PRINTER REVIEW

Slam! *Whirrrrrr!* Buzzzzzzz! Clank! Bam! "Damn!"

Smarter, faster laser printers, 24-pin dot matrix machines with high-quality output, and workhorse 9-pin models crowd the 1988 printer market.

PC Labs is normally a quiet corner of *PC Magazine*'s editorial offices, where the loudest noise heard is the subdued whoosh made by the cooling fans of 20 or so PCs as they do their thing. That changes when the annual printer project takes over, and the cacophony of machine-made, gravity-made, and human-made noises is almost overwhelming. So is the crush of people and equipment that stacks up around the lab benches, making it just about impossible for unknowing visitors to thread their way through.

But all the noise and the crowding and the effort is worthwhile because the result is the annual *PC Magazine* printer issue. This is the fifth such issue, and previous editions have been interesting enough that thousands of you have written, called, talked to *PC Magazine* editors at user groups and trade shows, grabbed us on the street, or sent us messages on MCI Mail, just to make sure we knew how much you have valued them.

Your needs, your responses, have spurred us on and kept us going. So each year we review yet more new-model printers and improve the benchmark tests at PC Labs. This year's crop of 90 printers brings the total number we've reviewed and tested to 481. That's a sizable number for any kind of product tests and reviews—in or out of the computer industry—and it probably sets some sort of high-watermark in someone's record book.

The latest printer benchmark tests and testing scripts are the most comprehensive ever, consisting of 2,500 lines of source code and 25 to 100 pages of output per printer. Depending on the complexity of the printer being tested, going through the script and running the tests takes from 2 hours to 2 working days. A balky printer that doesn't like working with a PC (or just doesn't like to work at all) can stretch the process out and take a couple of weeks

from a reviewer's schedule.

New this year are a graphics speed test for all printers and a combined text/graphics speed test for PostScript printers, but old this year are the same text-throughput speed test designed for our very first printer issue in 1984 and a suite of other tests you may have become familiar with over the years. That means this year's results are directly comparable with those printed in most previous printer issues, so you can compare results among this year's models and earlier ones. Key data for printers tested in the past is found in *PC Magazine*'s annual Index to Printers. For a complete rundown on PC Labs' procedures for testing printers, read Stephanie Izarek's article "How We Tested the Printers."

PRINTER POPULARITY It's no surprise that so many of you are interested in printers and responsive to *PC Magazine*'s printer issues. According to a recent PC MagNet survey, 98 percent of you have a printer hooked up to your PC at the office, at home, or both. That makes floppy disk drives the only PC peripheral used by more of you than printers.

The PC MagNet survey discloses that half of those printers are 9-pin dot matrix models; it also turns out that 65 percent of you are previous owners of 9-pin printers. That makes these modestly priced workhorses sure best-sellers in an expanding PC industry, which readily explains why every year there are so many new 9-pin printer entries into the market.

An additional 22 percent of you are impact printer users looking for higher-quality output, so you have 18- or 24-pin matrix printers. That makes a total of 73 percent of you using impact dot matrix printers of some type. Only 5 percent of you still use daisy wheel printers, and the rest of you use nonimpact printers.

Laser technology and similar technologies such as LCD and LED shutters are the clear leaders of the nonimpact crowd, according to the survey. Over 19 percent of you have some kind of laser printer today, but only 2 percent of those machines are the more powerful PostScript models. While that 19 percent is growing, it puts lasers third in the printer population race.

Laser printers are fast and quiet, and they produce superb results, so you'd think all PC users would want one on their desks. Price seems to be the major factor that keeps low-tech 9-pin impact matrix at the top of the printer-industry best-seller list. The list price of a typical 9-pinner is under $500—street prices go below $200—while a 24-pin model goes for less than $1,300. Lasers, on the other hand, start at $1,299 and go up to $8,000—or more if you add accessories. And dis-

HOW WE TESTED THE PRINTERS

Every year, PC Labs is faced with the challenge of improving its printer benchmark tests to reflect the latest technological innovations in the printer market.

Because the annual printer review is *PC Magazine*'s largest evaluation project and most comprehensive issue of the year, research and the development of new benchmark tests begin long before the first printer enters PC Labs. The project leader is assigned the responsibility of revising the tests to reflect the latest technological enhancements and to provide the type of information most important to printer buyers.

The speed tests for wide-carriage dot matrix printers were introduced last year and are still in use; for the narrow-carriage printers (including all laser units), PC Labs went back to the test document that was created for the first printer issue in 1984 and used through 1986. Therefore, all this year's speed results can be compared with those of previous years if you bear in mind that the 1987 test yielded slightly faster ratings for most printers (you'll find speed-test results from the past in the Index to Printers). Because our test times a printer's speed over two printed pages, our results are almost always slower than the speeds claimed by manufacturers, who usually clock a one-line "burst" speed.

The font and features output test for a printer's main emulations resembles the one we've used before, but behind the scenes the program now provides the control codes, ensuring that the emulations are executed properly.

Because more people are using graphics—and graphics speed is not always in sync with text speed—we have added a graphics speed test for all printers this year. And since PostScript-compatible laser printers can process our standard graphics speed test in a matter of seconds, we have added a special speed test for PostScript printers. This test loads a typeface outline, builds and sizes a large font, and then rotates it 90 degrees. The test then writes several characters in the font and uses them as an outline of the area to be printed.

Another improvement is the introduction of a new font test for PostScript printers. The program instructs the printer to print a list of the resident typefaces and a single sample page of each.

As usual, our 16-page printer guide provides the results of the tests. All of these results are presented in tabular form, thereby facilitating comparisons among all of the printers. Also included are a graphics-output sample and a text-output sample showing fonts and features. The quotation used for our "real-world" text sample was taken from Henry David Thoreau's *Walden*.

This year's revised benchmark tests are available through *PC Magazine*'s PC MagNet electronic bulletin board. Text speed tests, graphics speed tests, fonts and features tests, and PostScript speed and font tests are included in the benchmark suite.

Evaluations of each printer follow. Each review is accompanied by a photograph and a fact file, which contains manufacturer and pricing information along with a brief summary of the printer's features.—**Stephanie Izarek**

Stephanie Izarek is an editorial assistant at PC Magazine.

counted prices still aren't low enough to make laser printers competitive with impact printers.

Intuition would tell you that a price gap of that magnitude would make a difference to corporate buyers looking to equip individual PCs with printers. The PC MagNet survey asked at what price companies would begin buying single-user laser printers. Over 80 percent of you replied that prices would have to fall to $1,200 or below, and the response to another question indicated that this low price would have to be for graphics-capable printers.

There's a ways to go yet before lasers really take over the printer market.

This year's printer issue covers only matrix and laser printers, including their LCD and LED cousins. A few daisy wheel printers are still being produced, but no new models have come this way in recent memory, and you shouldn't expect to see one anytime soon. Lasers, along with 24-pin matrix printers, have replaced them in the letter quality market, taking up just about the same share of the printer market that the petal-wheeled pets of the past used to own. R.I.P.

DE FACTO STANDARDS Most 9-pin printers use print enhancement and formatting codes that emulate the popular Epson FX-series printers or the IBM Proprinter series in both text and graphics modes, which makes those two printer protocols the de facto standards. Matrix printers with 24-pin heads have a strong tendency to follow the Epson LQ-series protocols, making that an additional de facto matrix printer standard. Many printers are dual- or multiple-mode, and some continue to use proprietary coding standards, although most also include a more common one.

This year's group of laser printers includes 9 PostScript printers and 24 that emulate the already legendary Hewlett-Packard LaserJet Series II, which was introduced—and reviewed here—last year. Some laser printers also emulate the old Diablo 630 standard popularized in the daisy wheel days of this industry. And some models emulate some other letter-quality or graphics printer, or contain a proprietary standard, usually as an alternative emulation mode. But HP and PostScript have become the important de facto standards in the laser end of the industry.

The existence of these de facto printer standards is a good yet fragile thing. It's good because the days are gone when printer designers went off and did everything their own way. That means the chances are strong that when you uncrate your next printer, it will already work properly with your favorite software. Don't worry that you're going to lose capabilities, either. The printers emulated in these standards are quite capable and should be no less effective for you.

The use of standards doesn't mean that creativity is dead; designers keep adding new features to their printers, right on top of the standard ones. That can be good, but that's where the fragility of de facto standards comes into play. New features can lead to unfortunate quirks that make some printers less than wholly compliant with the standards set by the printers they emulate. As a result, most software that depends on text or graphics output to printers still gets shipped with diskettes full of printer drivers customized for each make and model on the market.

So far, no standards board has stepped forward to enforce these de facto standards and eliminate such quirkiness. That's a shame, because enforceable printer standards would help more people than they would hinder. Meanwhile, here's *PC Magazine*'s fifth annual printer issue. It's the best—if not the biggest—one ever, and so are the printers in it.—**John Dickinson**

John Dickinson is the director of PC Labs.

OUR REVIEWERS

Bruce Brown is a principal of Soft Industries, a Connecticut-based computer consulting firm. He is the founder of the Connecticut Computer Society and has taught business uses of computers at various colleges. Brown also worked on the last two printer projects.

Carol Olsen Day is senior editor of *PC/Computing* magazine. Based in both New York and Cambridge, Massachusetts, she also writes for television and is the author of six books, the most recent of which is *The New Immigrants*. This is the third printer issue for which she has been a reviewer.

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The PC Magazine Printer Guide

PC Magazine's *Printer Guide provides data pertinent to your printer purchase decisions. Results come from PC Labs benchmark tests and hands-on evaluations.*

Paper size

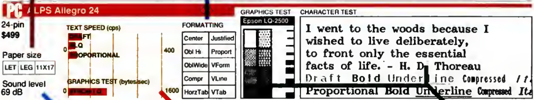
Different printers are capable of handling different sizes of paper. The three boxes under the Paper-size heading indicate which sizes a printer can accommodate.

LET	8½ by 11 inches
LEG	8½ by 14 inches
11X17	11 by 17 inches

Features

A list of each printer's printing and formatting features tells you how far beyond plain-vanilla printing it will go. Formatting features are noted here in the printer guide, while information about type features (such as boldface, italic, and underline) are listed in the emulation boxes that accompany each review.

Center	Centered type	Justified	Text justification
Dbl Hi	Double-high type	Proport	Proportional spacing
DblWide	Double-wide type	VForm	Variable form length
Compr	Compressed type	VLine	Variable line heights
HorzTab	Horizontal tabs	VTab	Vertical tabs



Sound level

The intensity of sound is measured in decibels (dB); each 10-dB increase represents a doubling in volume. The average printer pounds away at 72 dB. Compare that with the 20 dB of rustling leaves, the 50 dB of the average office, or the 120 dB of a rock concert. Although our equipment doesn't test accurately below 50 dB, manufacturers' ratings indicate that the laser printers are well below that level. For dot matrix printers, the tested sound level is listed in the lower-left-hand corner of each box.

PC—Indicates Editor's Choice

Speed

A variety of tested speeds are reported on the bar charts included with each printer listing. For dot matrix printers, speed was measured in characters per second and was tested using a 3,621-character, two-page business letter, run once. Reports normally include a draft speed, a near-letter-quality speed, and a proportional-spacing speed. A timing for high-speed draft mode or for correspondence mode (usually between draft speed and NLQ speed) is reported where applicable. For wide-carriage printers, a wide-carriage draft speed is also reported; this may differ from the narrow-carriage draft speed.

For each printer capable of graphics, one graphics speed test result is shown. The emulation under which it was conducted is listed within the bar.

For the laser speed test, the same typical, two-page single-spaced business letter was used; it was printed ten times. Tested speed is measured in pages per minute. The results of the graphics speed test are reported beneath the text speed results. Each PostScript printer listing includes a result for the special PostScript-specific graphics speed test, which is more challenging than the normal graphics speed test.

Print quality

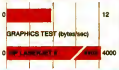
To allow you to judge the quality of text output, four lines of the best-quality type and up to three lines of different font samples are shown. The graphics samples—a gray scale and a series of rules—were created using Aldus Corp.'s *PageMaker* running under *Microsoft Windows*. In each case, the emulation used to produce the graphics sample is listed directly above it. Printers with no samples shown are unable to print graphics or are incompatible with our tests.

The PC Magazine Printer Guide: Laser Printers

Acer LP-76

Laser
$1,999

Paper size
LET | LEG



FORMATTING

	VForm
	VLine
HorzTab	VTab

GRAPHICS TEST

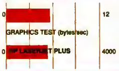
CHARACTER TEST

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier **Bold** Underline Compres
Line Printer **Bold** Underline Compressed Italic Super

ALPS LPX600

LED
$2,795

Paper size
LET | LEG



FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

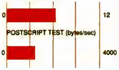
CHARACTER TEST

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier Bold Underline Compress
Line Printer **Bold** Underline Compressed Italic Super

Apple LaserWriter IINT

PostScript laser
$4,599

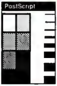
Paper size
LET | LEG



FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST



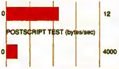
CHARACTER TEST

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier **Bold** Underlined *Italic*
Palatino **Bold** Underlined *Italic* Compressed

Apple LaserWriter IINTX

PostScript laser
$6,599

Paper size
LET | LEG



FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

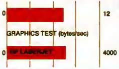
CHARACTER TEST

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier **Bold** Underlined *Italic*
Palatino **Bold** Underlined *Italic* Compressed

Blaser Star 2

Laser
$2,395

Paper size
LET | LEG



FORMATTING

	Justified
Dbl Hi	
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

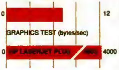
CHARACTER TEST

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier **Bold** Underline Compres
Line Printer **Bold** Underline Compressed Italic Compr

Brother HL-8

Laser
$2,695

Paper size
LET | LEG



FORMATTING

	Justified
Dbl Hi	Proport
DblWide	VForm
	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST

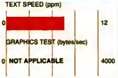
I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier **Bold** Underline Compres
Line Printer **Bold** Underline Compressed *Italic* Comp

The PC Magazine Printer Guide: Laser Printers

Canon LBP-8IIT

LED
$3,950

Paper size
LET LEG



FORMATTING

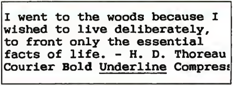
	Justified
	VLine
HorzTab	VTab

GRAPHICS TEST

None

Not Applicable

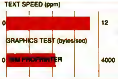
CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier Bold <u>Underline</u> Compress

Citizen Overture 110

Laser
$1,995

Paper size
LET LEG



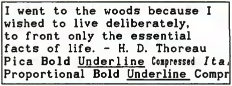
FORMATTING

Center	Justified
	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

IBM Proprinter

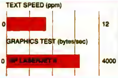
CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Pica **Bold** <u>Underline</u> Compressed *Ita*
Proportional **Bold** <u>Underline</u> Compr

C. Itoh Jet-Setter II

Laser
$2,195

Paper size
LET LEG



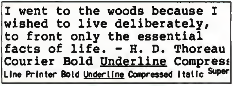
FORMATTING

	VForm
	VLine
HorzTab	VTab

GRAPHICS TEST

HP LaserJet II

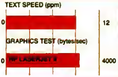
CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier **Bold** <u>Underline</u> Compress
Line Printer **Bold** <u>Underline</u> Compressed Italic Super

C. Itoh LIPS II

Laser
$3,545

Paper size
LET LEG



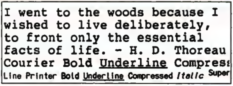
FORMATTING

	Justified
	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

HP LaserJet II

CHARACTER TEST


I went to the woods because I
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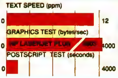
to front only the essential
facts of life. - H. D. Thoreau
Courier **Bold** <u>Underline</u> Compress
Line Printer **Bold** <u>Underline</u> Compressed *Italic* Super

Dataproducts LZR 1260

PostScript laser
$7,995

Paper size
LET LEG



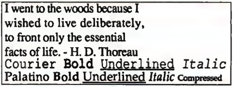
FORMATTING

Center	
	Proport
	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

PostScript

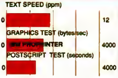
CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier **Bold** <u>Underlined</u> *Italic*
Palatino **Bold** <u>Underlined</u> *Italic* Compressed

IBM 4216 Personal Pageprinter Model 020

PostScript laser
$4,999

Paper size
LET LEG



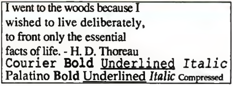
FORMATTING

Dbl Hi	Proport
DblWide	VForm
	VLine

GRAPHICS TEST

PostScript

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier **Bold** <u>Underlined</u> *Italic*
Palatino **Bold** <u>Underlined</u> *Italic* Compressed

Universal Printer Stand

Save Space, Save Money...Only $24.95

The new PS-1 Universal Printer Stand from Curtis holds any printer, standard carriage or wide, saves valuable workspace, and costs only $24.95. The PS-1 uses no more desktop space than the printer itself, and provides storage for input paper underneath the printer. Plus, a removable paper tray automatically stacks output.

Besides saving space, the PS-1 holds the printer at a slight pitch, to improve line of sight, saving you neck and eye strain. Give yourself more room to work, and a system setup that's more efficient and organized: The PS-1 Universal Printer Stand from Curtis — the experts in accessories. #PS-1 Retail...$24.95

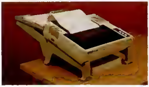
Curtis products are available nationally from leading Dealers, Distributors, and Retail Chains.
In Canada: Personal Computer Assoc. Inc., P.O. Box 235, Ajax, ONT, L1S 3C3, (416) 427-6612

For the Curtis dealer nearest you call (603) 532-4123 Ext. 871

Fits all printers, standard carriage or wide.

Improves line of sight for portable computers too!

Conveniently stores paper underneath, improves line of sight to printout, removable paper tray catches and folds printouts automatically.



Totally universal. Heavily constructed components, colored and textured to match or complement all microcomputer systems.

CIRCLE 472 ON READER SERVICE CARD

Manufacturing Company, Inc.
CURTIS
30 Fitzgerald Drive, Jaffrey, NH 03452
A subsidiary of Rolodex Corporation

Made in U.S.A.
Lifetime Warranty

An Insilco International Specialty Company

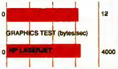
The PC Magazine Printer Guide: Laser Printers

Kyocera F-1000A

Laser
$2,895

Paper size

LET	LEG	



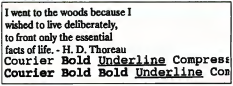
FORMATTING

	Proport
	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

HP LaserJet

CHARACTER TEST



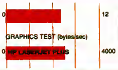
I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier **Bold** Underline Compress
Courier Bold Bold Underline Con

Office Automation Systems LaserPro Gold Express

Laser
$3,895

Paper size

LET	LEG	



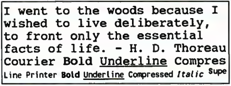
FORMATTING

Center	Justified
	Proport
	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

HP LaserJet Plus

CHARACTER TEST



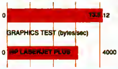
I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier **Bold** Underline Compres
Line Printer **Bold** Underline Compressed *Italic* Supe

Office Automation Systems LaserPro 1510R

Laser
$6,495

Paper size

LET	LEG	



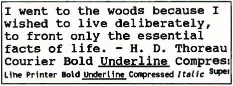
FORMATTING

Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

HP LaserJet Plus

CHARACTER TEST



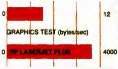
I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier **Bold** Underline Compres
Line Printer **Bold** Underline Compressed *Italic* Supe

Olympia Laserstar 6

Laser
$2,699

Paper size

LET	LEG	



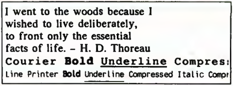
FORMATTING

Dbl Hi	Proport
DblWide	VForm
	VLine
HorzTab	VTab

GRAPHICS TEST

HP LaserJet Plus

CHARACTER TEST



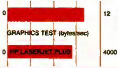
I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. – H. D. Thoreau
Courier **Bold** Underline Compres
Line Printer **Bold** Underline Compressed Italic Compr

Panasonic Laser Partner

Laser
$2,595

Paper size

LET	LEG	



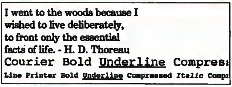
FORMATTING

Center	Justified
	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

HPLaserJet Plus

CHARACTER TEST



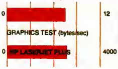
I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier Bold Underline Compres
Line Printer Bold Underline Compressed *Italic* Compr

QMS Kiss Plus 30

Laser
$3,920

Paper size

LET	LEG	



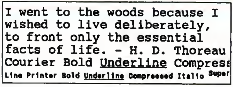
FORMATTING

Center	Justified
	Proport
	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

HP LaserJet Plus

CHARACTER TEST



I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier Bold Underline Compress
Line Printer Bold Underline Compressed Italic Super

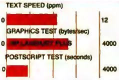
The PC Magazine Printer Guide: Laser Printers

QMS PS-810

PostScript LED
$5,495

Paper size

LET	LEG	



FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

PostScript

CHARACTER TEST

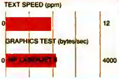
I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier **Bold** <u>Underline</u> Compres
Line Printer **Bold** <u>Underline</u> Compressed *Italic* Compr

Qume CrystalPrint Series II

LCD shutter
$1,999

Paper size

LET	LEG	



FORMATTING

	Proport
	VForm
	VLine
HorzTab	

GRAPHICS TEST

HP LaserJet II

CHARACTER TEST

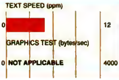
I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier **Bold** <u>Underline</u> Compres
Line Printer **Bold** <u>Underline</u> Compressed Italic Compr

Qume CrystalPrint WP

LCD shutter
$1,299

Paper size

LET	LEG	



FORMATTING

Center	Justified
	Proport
	VForm
	VLine
HorzTab	VTab

GRAPHICS TEST

None

Not Applicable

CHARACTER TEST

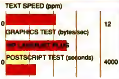
I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier monospace **Bold** <u>Underli</u>
Courier proportional **Bold** <u>Underline</u> Co

Qume ScripTEN

PostScript laser
$4,495

Paper size

LET	LEG	



FORMATTING

	Proport
	VForm
	VLine
HorzTab	VTab

GRAPHICS TEST

PostScript

CHARACTER TEST

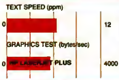
I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier **Bold** <u>Underlined</u> *Italic*
Palatino **Bold** <u>Underlined</u> *Italic* Compressed

Sharp JX-9300

Laser
$2,195

Paper size

LET	LEG	



FORMATTING

Center	Justified
	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

HP LaserJet

CHARACTER TEST

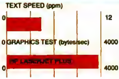
I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier **Bold** <u>Underline</u> Compress
Line Printer **Bold** <u>Underline</u> Compressed Italic Compre

Star Micronics LaserPrinter 8

Laser
$2,799

Paper size

LET	LEG	



FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

HP LaserJet Plus

CHARACTER TEST

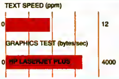
I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier **Bold** <u>Underline</u> Compres
Line Printer **Bold** <u>Underline</u> Compressed *Italic* $^{\text{Super}}$

The PC Magazine Printer Guide: Laser Printers

Tandy LP 1000

Laser
$2,599

Paper size
LET LEG



FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

HP LaserJet Plus

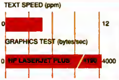
CHARACTER TEST

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier Bold Underline Compress
Line Printer Bold Underline Compressed Italic Super

Taxan Crystal Jet

LCD shutter
$3,495

Paper size
LET LEG



FORMATTING

Center	Justified
	Proport
	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

HP LaserJet Plus

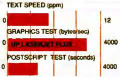
CHARACTER TEST

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier Bold Underline Compres
Line Printer Bold Underline Compressed Italic Super

Texas Instruments OmniLaser 2106

PostScript laser
$4,595

Paper size
LET LEG



FORMATTING

Center	Justified
	Proport
	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

PostScript

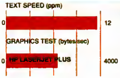
CHARACTER TEST

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier Bold Underlined *Italic*
Palatino Bold Underlined *Italic* Compressed

Toshiba PageLaser12

Laser
$3,799

Paper size
LET LEG



FORMATTING

Dbl Hi	
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

HP LaserJet

CHARACTER TEST

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier Bold Underline Compress
Line Printer Bold Underline Compressed *Italic* Super

A simple explanation of our new VGA Plus 16™ card.

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The new Paradise VGA Plus 16 card is the latest addition to our growing family of VGA products. Its 16-bit bus and BIOS rushes information to your screen up to 400% faster than IBM*'s Display Adapter. And its exclusive AutoSense™ feature guarantees trouble-free high performance.

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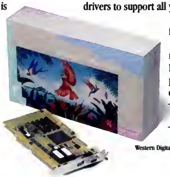
Plus you get complete hardware and software compatibility, including downward compatibility with all pre-VGA standards. And the Paradise VGA Plus 16 card comes complete with a long list of software drivers to support all your favorite programs.



In simple terms, it's the best high performance value going. At only $499 retail.

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Western Digital Imaging

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†640 x 400 mode works with PS/2 and MultiSync monitors. VGA Plus 16, AutoSense, VGA Plus and VGA Professional are trademarks of Paradise Systems, Inc. *IBM is a registered trademark of International Business Machines Corp.

CIRCLE 359 ON READER SERVICE CARD

ClearCase™ Mouse–Special Edition From Logitech.

To celebrate the shipment of our two millionth mouse, we took the covers off our winning technology.

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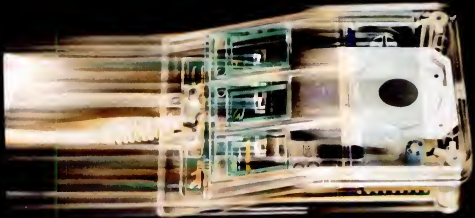
for Christmas.



like PaintShow™ which, it so happens, comes with your ClearCase Mouse.

You get everything for $149. The package includes: the Logitech ClearCase Mouse for IBM PC, XT, or AT and PS/2 or 100% compatibles; a 9-25 pin adapter; Plus Package™ software; and Logitech PaintShow™ (which requires a graphics card).

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CIRCLE 182 ON READER SERVICE CARD

LaserPro
EXPRESS
LETTER
LEGAL

LASER PRINTERS

Another Year Older, Another Year Wiser

At the high end, PostScript is faster and smarter. At the low end, liquid crystal shutter machines offer text-only output at bargain prices. And in the wide midrange, the HP LaserJet Series II holds up well against fierce new competition.

In 1984 PC Labs tested one laser printer for the annual *PC Magazine* printer issue. Not surprisingly, it was the Hewlett-Packard LaserJet, the printer that broke the dam and opened desktop computing to the superb quality and silent operation of laser printing. The only other page printer reviewed that year was the soon-to-be-forgotten Diablo EPM-1 thermal transfer printer.

Daisy wheel printers still ruled the letter-quality-printing roost. But the handwriting was clearly on the wall, and since that time laser printers have taken that market over and eroded the market for pen plotters as well. Since 1984 we've tested and reviewed 85 laser printers altogether: 3 in 1985, 18 in 1986, 36 in 1987, and 28 this year. That spells a successful market, and our PC MagNet survey results prove the point. Lasers aren't number one, but they have arrived solidly in the PC printer

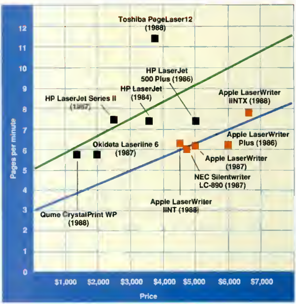
Illustration: Izumi Inoue

Laser Printers: Bang for the Buck

As you can see in the dot matrix "bang for the buck" graphs, plotting a printer's price against its speed can highlight some inexpensive, high-performance machines while revealing some potentially overpriced or slow models. For laser printers, the speed is measured in pages per minute.

Because PostScript printers are significantly more expensive than non-PostScript models, two lines have been laid on the graph. The blue line indicates the average for PostScript printers, and the green line is the average for non-PostScript printers.

Bang for the buck should not be your sole criterion when shopping for a printer. Use the information in conjunction with the reviewers' evaluations to get a complete picture of each printer's capabilities. For example, while noting that the Qume CrystalPrint WP has an excellent price/performance ratio, keep in mind that the machine has no graphics capabilities and no typefaces other than Courier available.



business, and most of them are being used on individual desktops.

People didn't expect lasers to be hooked up to individual PCs when the LaserJet was introduced. At $3,495 plus font cartridges, it cost as much as or more than most PC configurations, and besides, not much software was around to support the then-new PCL codes embodied in the Canon-made engine's driver. Local area networks seemed a more logical target for these expensive but speedy and quiet machines.

Wrong. The LaserJet took off like a shot as individual users hooked it up to PCs all over corporate America. Office workers were tired of enduring hammering daisy wheel printers and whining dot matrix printers, and a LaserJet's price didn't seem much to pay for a little peace and quiet. There were some inconveniences to using a LaserJet, but they seemed to be justified, at least most of the time. As a result, while laser printers are still far from first place on a list of best-selling printers, thousands have been hooked up to individual PCs and, yes, thousands more have been hooked up to networks.

LaserJet inconveniences had a wide variety of influences on this market. For example, the original Canon engine had space for only 100 sheets of paper in its input bin and output tray. Sheet feeders that would handle large capacities, multiple bins of paper, and even envelopes began showing up early in the laser game. Some units came with collators that would assemble multiple copies of reports into the correct page sequence (the original LaserJet couldn't assemble even one copy into its correct sequence) and put letters together with their properly addressed envelopes.

This year's assortment of lasers carries on the tradition of flattering Hewlett-Packard by imitation.

Printer-sharing devices began to be touted as low-cost (non-LAN) answers to the high cost of laser printing. Many of them come with print-queuing and spooling capabilities that would put mainframe operating systems to shame, not to mention local area networks.

INCOMPATIBILITY INNOVATION
Software incompatibility provided a wide playing field for innovators with all sorts of solutions. Third-party utilities that magically transformed output designed for other printers into LaserJet format started showing up all over the place. Third-party vendors also produced LaserJet printer drivers compatible with popular software products, especially word processors and spreadsheets. Similar fixes and patches became available both in user groups and on

bulletin boards, where the price was certainly right.

PC add-on cards appeared, and they too worked magic by transforming the LaserJet into something else. Boards that replaced the LaserJet's controller also came on the scene. Unfortunately, the LaserJet sometimes got transformed into something equally foreign to your software. On the other hand, a few products can now turn a LaserJet into a PostScript printer.

Software vendors were likewise excited by the new laser technology, and sooner than a lot of people expected, word processing and graphics vendors caught up with the LaserJet and began to ship compatible products as well as fixes for existing products. That meant the LaserJet had come of age, and users could rely on *supported* compatibility from original software vendors rather than add-on products.

As software support spread, LaserJet clones came along, stiffening the competition Hewlett-Packard had to face. The challenge was quickly met by the LaserJet Plus, which accommodated more memory for graphics plus downloadable fonts to replace or supplement the company's expensive font cartridges.

The clones kept coming anyway, most of them meeting the capabilities of the Plus and many of them adding more features. Some of them gave you more memory and a better selection of fonts, while others gave you more paper capacity and even envelope handling, and still others had faster print engines and alternative printer emulations so you could use the printer with software that still didn't support the LaserJet. Many of them gave you those capabilities at a lower price.

By this time last year, Hewlett-Packard, along with Canon, had most of the answers to users' problems in the form of the LaserJet Series II. Its new Canon LBP-SX engine is smaller and quieter and produces higher print quality than the previous model. The engine is notable because it retains the outstanding everything-in-a-cartridge approach to toner and drum packaging found in the original engine, albeit in a smaller cartridge that's easier to load. The Series II controller is notable for its additional memory capacity—up to 4.5MB can be installed—and the menu system and accompanying front panel that displays words to go along with the LaserJet codes. And the printer costs $1,000 less than the original LaserJet.

LASER EMULATION GRID EXPLANATION

Because so many printers offer a variety of high-quality typefaces this year, a chart of emulations and their characteristics appears at the beginning of each review. Within each chart there is one grid to represent the printer's native mode and another to represent the printer's highest-quality emulation. If only one emulation is available, its characteristics are displayed in the native-mode grid.

(Those laser printers that have a dot matrix emulation are accompanied by a dot matrix grid that displays the available pitches and enhancements. Please refer to the grid explanation within the introduction to dot matrix printers.)

Across the top of each laser emulation grid, the four most commonly used typefaces are listed: Helvetica, Times Roman, Courier, and Line Printer. Down the left side of the grid are the most commonly used point sizes: 8/9, 10, 12, 14, and SF. The 8/9 designation indicates that either 8-point or 9-point type is available. *SF* stands for *scalable font*, a term used to indicate that the emulation is capable of producing any point size (all PostScript printers have this feature).

Under each typeface in the grid are four columns with colored squares representing commonly used printing enhancements: blue—for bold, green—for italic, yellow—for super/subscript, and red—for underline. The configuration shows which enhancements are available in each typeface and size.

—Stephanie Izarek

POSTSCRIPT PARALLELS Lest we forget, a parallel laser-technology development started on the Apple Macintosh side of the PC universe. PostScript is generally acknowledged to be the most versatile page-description language available. The Apple LaserWriter was the first (and for a long time the only) printer to have it, and PostScript has set the standard for desktop publishing and many graphics applications.

The Apple LaserWriter went through a major change when the LaserWriter II was announced. Like the HP LaserJet Plus and the Series II, the new model from Apple had more memory available to keep up with the burgeoning graphics world. And as with the LaserJet, many add-on and alternative products that have been introduced as software products gather to support the PostScript standard. This year Apple Computer has announced a considerably larger and faster series of LaserWriters that cooperate more easily with IBM-compatible PCs.

THE 1988 HARVEST This year's assortment of lasers carries on the tradition of flattering Hewlett-Packard by imitation while improving the LaserJet breed and providing PostScript capabilities; a few do all of this at the same time. Some of the emulations are built into the printers, and others come on cartridges the size of an ordinary credit card. Print-engine speeds now range up to 18 pages per minute, and paper capacity can go up to a whopping 750 sheets.

Some machines are trying to beat Hewlett-Packard on both price and performance, but the majority of the printers at the high end of the laser game are not trying to compete on price. It costs too much money to develop the electronics and acquire the high-performance engines some of the more versatile machines require. And while price does deter low-end printer users from entering the laser market, it hasn't stopped the market from growing at astronomical rates.

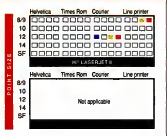
As a result, prices are down a bit, but prices over $3,000 are not extraordinary, and a fully configured—and incredible—12-ppm Dataproducts LZR 1260 can set you back $7,995 (and, that's a network printer by anybody's standards). PostScript printers using the full Adobe licensing arrangement are also expensive simply because the license is so expensive. That explains why the 6-ppm Texas Instruments OmniLaser 2106 can set you back $4,595.

You don't have to spend that kind of money to get into the laser printer game. There's a surge at the bottom of the price heap, and it'll probably get the attention it deserves: Qume's tiny CrystalPrint WP goes for $1,299. Now it would be nice if that were an unqualified $1,299, but this Casio LCD shutter–engined printer is capable of printing only in Courier type and only in a word processing mode based on the Diablo 630 control protocol. Forget graphics, forget flexible fonts, forget landscape layout and all that good stuff if you buy this printer, but it does set a new price standard for affordable laser printers and will have lots of competition by this time next year.

Thus you'll find a wide range of prices, features, quality, and performance in the laser market today. A few of these are genuinely poor choices, but most will give you lots to think about. So read on, think about it, and check toward the back for our selections of Editor's Choice laser printers—they just might surprise you!

—John Dickinson

Acer LP-76



The Acer LP-76, jointly marketed by Acer and Destiny Technology (which has produced the Laser Act line in recent years) is best described as a $1,999 HP LaserJet II clone that happens to use a Ricoh engine rather than the LaserJet's Canon engine. As you might expect, the biggest differences between the LP-76 and the LaserJet II result from the different engines.

The printer's speed, for example, is limited by the Ricoh's 6-page-per-minute rating. And indeed, on the PC Labs text speed test, the LP-76 managed just 5.8 ppm, compared with 7.5 for the LaserJet II. But on the graphics speed test it was an impressive 40 percent faster than the LaserJet II, with a time of 95.6 seconds. The LP-76 manual claims that on a page containing both text and graphics, the LP-76 will typically print about 25 percent faster than the LaserJet II.

Print quality is another feature determined primarily by the engine. In general, the Ricoh's print quality falls somewhat short of that of the second-generation Canon engine. On the PC Labs tests, however, the LP-76 output for both graphics and text looked better than is typical for Ricoh engines. Graphics had sharp detail, and the blacks of filled-in areas were solid. Text characters were crisp and dark.

Other factors determined by the engine include paper handling, installation procedure, and overall ruggedness of the printer. Like other Ricoh-based printers, the LP-76 holds only 150 pages in both its input and output trays.

One other important difference between the Ricoh and the Canon engines is the number of slots for font cartridges. The Canon has two, and the Ricoh has only one. This doesn't bother Acer, since the company offers a double-font-cartridge adapter for the LP-76. The adapter plugs into the single slot and contains two new slots for cartridges. Acer offers a total of 21 font cartridges for the printer, soft-font disks, and a $299 cartridge that adds HP plotter emulation to the printer.

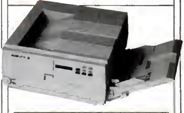
The manual provided with the LP-76 contained all the information needed for controlling the printer from the front panel, but it lacked information on the printer control codes. A revised manual—complete with control codes—is now available.

Like the LaserJet II, the LP-76 has three resident typefaces: Courier, Courier Bold, and Line Printer. Each of these is available in both portrait and landscape orientation, and each of the fonts is available in any of 23 symbol sets. For most users, the two most important are Roman 8 (the usual LaserJet high order characters) and IBM-US (the IBM high-order characters). Other character sets are designed for specific foreign languages.

In PC Labs text and graphics emulation tests, the LP-76 performed without problems. On the high-order-character test, the results depend on the current character set. We had success with both the IBM high-order characters and the Roman 8 characters.

By all measures, the LP-76 is a suitable clone of the LaserJet II. At this writing, however, the list price on the LP-76 is more than $300 above the street price of the LaserJet II, which means that the value of this printer will depend largely on its eventual street price. One other consideration is a promised PostScript board that will fit in your PC. With a projected price of $1,790, the board will complete a printer package with HP and PostScript features for under $3,800 list.**—M. David Stone**

PC FACT FILE



Acer LP-76
Acer Technologies Corp.
401 Charcot Ave.
San Jose, CA 95131
(408) 922-0333
List Price: $1,999
Dimensions (HWD): 8 x 25 x 16 in.
Weight: 38 lbs.
Emulations: HP LaserJet II, HP Graphics Language (optional)
In Short: This solidly performing LaserJet II clone has a list price about $300 above the street price of the real thing. Ultimately, its attractiveness will depend on how low the clone's street price turns out to be.

CIRCLE **667** ON READER SERVICE CARD

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Easy decision.

After all, 1-2-3 Release 2.01 has recently been rated the top-performing spreadsheet for an unprecedented fifth straight year by the NSTL.[2] In fact, 1-2-3 is the backbone of business, with over 7 million users who depend on it everyday.

Plus, the upcoming 1-2-3 Release 3[3] will be the most powerful spreadsheet on the market by far, yet it will offer the familiar 1-2-3 interface and be fully compatible with all your present 1-2-3 data, macros and applications.

The new 1-2-3 will offer an exciting 3-dimensional spreadsheet for better organization and consolidation of data. Plus, improved graphics and powerful database enhancements, including the ability to access external databases, like dBase®, from within your spreadsheet.

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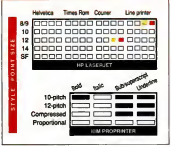
Lotus 1-2-3

(1) Upgrade offer valid September 6, 1988 through 30 days after the 1-2-3 Release 3 ship date. (2) National Software Testing Laboratories, Inc. Software Digest Ratings Report, June, 1988
(3) 1-2-3 system requirements will vary from Release 2.01 to Release 3. 1-2-3 Release 3 runs under DOS and OS/2, Hard disk and 640K required. Lotus certified compatible PC with 80286 processor or better recommended.
Lotus and 1-2-3 are registered trademarks of Lotus Development Corp. dBase is a registered trademark of Ashton-Tate Corporation

ALPS LPX600



The first page printer from ALPS certainly draws attention. People walking past it in PC Labs exclaimed, "Oooh, look how cute!" With a list price of $2,795, the LPX600 also has some cute tricks hidden away where you can't see them.

The printer weighs only 38.6 pounds; few weigh less. This compact package still offers a full range of paper-handling options. Faceup output, facedown output, cassette feed, manual feed, straight-through path—the LPX600 has them all.

This printer is a polyglot as well. It handles the compulsory LaserJet Plus command set without a single hitch and then goes on to cover the popular dot matrix and daisy wheel turf as well: IBM Proprinter, IBM Graphics Printer, Epson FX, and Diablo 630.

The fact sheet shows a potential shortcoming: only the Courier and Line Printer fonts are listed. This is a shining example of a manufacturer's making claims that are too conservative. Some companies ship a computer with two fonts and a few dozen foreign-language symbol sets for the high-order characters, and then lay claim to a hundred standard fonts. ALPS takes the opposite route. There are only two sets of fonts in the machine's ROM, but the controller is so intelligent that it can work wonders. The LPX600 creates many useful fonts on the fly, including bold, italic, and compressed versions of the Courier and Line Printer fonts.

The computer comes with a memory-resident configuration program as a standard feature, which you can use as an alternative to the front panel for setting options. The same disk also includes an assortment of LaserJet-format downloadable fonts. These are provided through an agreement with VS Software, a well-known player in the soft-font marketplace. To make certain that you have room to work with these fonts, the LPX600 comes with a full 2MB of RAM, four times the amount provided with the similarly priced HP LaserJet II.

The Sharp print engine used in the LPX600 produced crisp blacks with no apparent washout or loss of definition at the edges. The LaserJet emulation was flawless in both text and graphics. The two dot matrix emulations suffered from some minor horizontal striping problems.

With all this going for it, what more could you possibly ask from this printer?

Speed. The print engine is rated at only 6 pages per minute, which is fine for a printer that might cost $1,000 less but gets harder to take as you near the $3,000 mark. The PC Labs speed tests produced results ranging from 5.7 ppm in LaserJet-mode to 6.1 ppm in Diablo mode. This is one of the few times that a printer has turned in a time faster than the manufactur-

WHEN BAD THINGS HAPPEN TO GOOD PRINTERS

Always remember that the more complex the printer, the more likely something may eventually go wrong with it.

What happens when a sophisticated laser printer malfunctions within the first few months after its purchase?

In the case of the Ricoh-engine-based Okidata Laserline 6, a *PC Magazine* Editor's Choice in 1987, it meant a lawsuit. The class-action suit was filed against Okidata and Ricoh on April 29 in U.S. District Court in Philadelphia by John P. Oakes, Jr., of Mont Clare, Pennsylvania.

The suit charges that up to 80 percent of the Laserline 6 printers sold produced shadows, blurs, and splotches on printouts and that Okidata "never recalled the units, never warned potential customers about the defects, and never withdrew the product from the market to correct the defects."

The Laserline 6 printers are built with Ricoh's 6-page-per-minute engine. Although other large manufacturers have chosen the same engine—most notably IBM and Epson—few laser printers have sold as widely as the Laserline 6, which has a street price of around $1,400.

Both Okidata and Ricoh spokespeople refused to comment while the legal action is pending, but Okidata representative Cliff Rockwell said that the problems with the Laserline 6 have been corrected and new drum kits have been made available to users at cost.

PC Connection, a mail-order house in Marlow, New Hampshire, reports that there were so many customer complaints about the Laserline 6 that they were forced to stop selling it. John Eroszonak, purchasing manager, says, "We took back a lot of machines because people had problems with shading and lines." Eroszonak claims the source of the print errors lies with defective drum kits in the machine's Ricoh engine.

Several *PC Magazine* readers wrote in to complain about the printer. Ron Usher, a lawyer at the office-automation consulting firm Webber & Usher in Vancouver, British Columbia, says he put in more than 100 unbillable hours over 6 months trying to resolve problems with Laserline 6's he had recommended to his clients. The six printers that he worked with had smudging and toner problems. Only two are still in use, and those had the drum kits replaced after several months in which Okidata, according to Usher, ignored the failures. "It was a total disaster," Usher recalls, "both for me and for the vendors who supplied the printers."—**Gretchen Luchsinger**

PC MAGAZINE FACT FILE

ALPS LPX600
ALPS America
3553 N. 1st St.
San Jose, CA 95134
(408) 432-6000
List Price: $2,795
Dimensions (HWD): 12.5 x 17.6 x 16.75 in.
Weight: 38.6 lbs.
Emulations: Diablo 630; Epson FX; HP LaserJet Plus; IBM 5152 Graphics Printer, Proprinter
In Short: The LPX600 shows flashes of brilliance and demonstrations of quiet conservatism but finally falls short of the market in overall value. Watch for future offerings from ALPS, since the company is certainly on the right track.
CIRCLE **665** ON READER SERVICE CARD

er's rating. Still, 6 ppm is slower than much of the competition, and the graphics times are slower still.

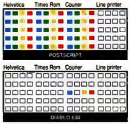
Life expectancy. The engine is rated for only 200,000 pages. This is a new printer based on a new engine, so it remains to be seen just how optimistic or conservative this estimate will prove to be. If it is correct, the machine is rated to run just a ream and a half of paper each week over its 5-year life.

Flexibility. Adherence to emulation compatibility is a good thing in general, since it prevents the user from getting some nasty surprises. Still, it seems that ALPS is wasting a clever mind in the LPX600 controller. Here is a brain with the smarts to create bold and italic characters on demand for the Epson and Proprinter emulations, yet it refuses to do so in LaserJet mode.

Front-panel friendliness. Including a configuration program is nice, but memory-resident software filling up my computer's RAM isn't. The front panel gives you access to a wide range of settings, but it communicates through a cryptic two-character window that uses seven-element characters. Rather than simply using pure numeric codes, the LPX600 tries to create mnemonic messages with upper- and lower-case letters along with digits. A few more characters in the message window would go a long way toward making the front panel much easier to use.

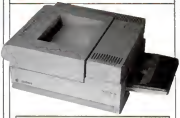
Plenty of memory, good paper handling, and emulations are offset by slow output, a cryptic front panel, and a short life. For its list price, the LPX600 fails to offer a compelling value, but it does show that the folks at ALPS are working in the right direction. Perhaps their second laser will develop more of a competitive edge.
—Alfred Poor

Apple LaserWriter IINT and IINTX



EDITOR'S CHOICE

PC MAGAZINE FACT FILE



Apple LaserWriter IINT and IINTX
Apple Computer Inc.
20525 Mariana Ave.
Cupertino, CA 95014
(408) 996-1010
List Price: IINT, $4,599; IINTX, $6,599
Dimensions (HWD): 8.25 x 18.5 x 18.5 in (both models)
Weight: 45 lbs. (both models)
Emulations: Diablo 630, PostScript (both models); HP LaserJet Plus (NTX only)
In Short: Both LaserWriters, the NT and the NTX, are improvements over the classic LaserWriter Plus they replace, offering more speed, especially in graphics output—and in the case of the NTX, excellent expandability.
CIRCLE **666** ON READER SERVICE CARD

Once again, the mouse has roared. Apple Computer, which first brought the power of PostScript to laser printing, continues the evolution of its LaserWriter line with the LaserWriter II—two distinct versions, in fact: the $4,599 NT and the $6,599 NTX. If you're familiar with some of Apple's problems in connecting with the PC world in the past, fear no more. The new LaserWriters are the most PC-friendly printers Apple has ever produced.

With the NT and the NTX, Apple has refined the concept of the universal engine. Using the 8-page-per-minute, 300-dot-per-inch Canon LBP-SX xerographic engine as its mule, the NT classification refers specifically to the controller board (with output ports) that is plugged into the engine. Likewise, the NTX is another controller board, but with a good deal more power and expansion capability. The two printers have the same size, shape, and weight.

Both models are equipped with the standard Apple typeface family introduced with the LaserWriter Plus: Courier, Helvetica, Times Roman, Palatino, Bookman, Avant Garde, New Century Schoolbook, Symbol, ITC Zapf Chancery, and ITC Zapf Dingbats (Dingbats is a collection of symbols). There is no support for the high-order IBM character set.

The NT is the low-end model, powered by an 11.5-MHz Motorola 68000 CPU. Its standard features include 1MB ROM for the PostScript code, 2MB RAM (nonexpandable), and RS-232, LocalTalk, and Apple Desktop Bus interfaces.

The NTX is the power model. It has a Motorola 68020 processor running at 16.7

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CIRCLE 743 ON READER SERVICE CARD

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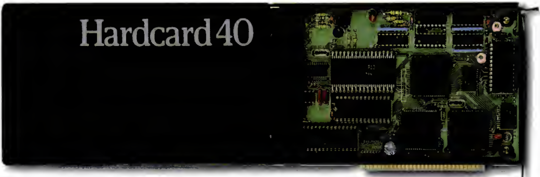

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CIRCLE 164 ON READER SERVICE CARD

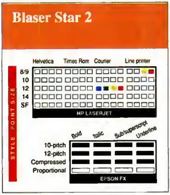
MHz and the same 1MB ROM for PostScript, but that's the only similarity. The NTX base configuration contains 2MB RAM in two 1MB SIP packages, but the board is expandable to 12MB. The NTX also comes with a SCSI interface that may someday connect to a PC-compatible hard disk that will contain additional typefaces.

In the PC Labs printer speed test, the NT clocked in at 6.4 pages per minute, while the NTX achieved 6.8 ppm. Because resident fonts do not exist in a PostScript engine, these times include the delay needed to image the selected font (we used the default Courier) before the first page was printed.

Older LaserWriters as well as the NT and NTX models are all rated at 8 ppm. The difference here lies in the distinction between paper-delivery speed and throughput speed. When we used the PC Labs graphics speed test, the NT's first page out took 74 seconds, while the second and third pages each took 35.3 seconds. The 38.7-second gap represented the time it took the NT to image the requested fonts. Displaying its speed advantage, the NTX needed 47.6 seconds to pump out the first page, with the second and third each arriving after 33.1 seconds. Imaging time for the NTX was only 14.5 seconds—nearly half that of the NT. All these times place the printers near, if not at, the top of the PostScript heap.

The NTX features HP LaserJet Plus emulation (both models have Diablo 630 emulation), and its communications handshaking protocol (XON/XOFF, ETX/ACK, or DTR hardware handshaking) is selectable from a DIP switch at the controller's mounting panel. The NT board's switch arrangement, however, works solely to select among Batch, Interactive, LocalTalk, or Diablo emulation. Handshaking changes (needed for some software, especially if you're using Diablo emulation) must be done through PostScript programming on the NT. Fortunately, Apple has expanded Appendix C of the user manual well beyond the original mode command instructions it considered adequate in the old version.

Anyone who's endured the awful slowness of most PostScript printers will be delighted by the speed of the new LaserWriters. The NT and the NTX are expensive options, but their many resident typefaces and their excellent speeds make them clear winners in the graphics-intensive PostScript category.—**Bill O'Brien**



Any laser printer not manufactured by Hewlett-Packard or Apple has to fight for market share. Vendors who want to sell machines must offer better pricing and more standard features than the market leaders. The Blaser Star 2, from Blaser Industries, is a terrific example of the kind of good buy you can get today. By both the numbers ($2,395 with 1MB of memory, $2,195 with 512K) and the observed performance, this unit is a good deal.

The Blaser Star 2 uses a laser engine designed by Blaser and manufactured by Sanyo. This engine is rated at 8 pages per minute and prints at 300- by 300-dot-per-inch resolution. In our tests the printer consistently worked at 7.4 ppm.

At 50 pounds the printer is no lightweight. Once you actually get it on the table or desk, however, the unit's design lets it take up only a little room, with an actual desk contact area of only 16.3 inches deep by 15 inches wide. The 250-sheet paper cassette fits in almost flush to the front of the unit, so you don't need to allow a lot of room for it. You can set the paper path for either C or S configuration to deliver the printed sheets faceup or in facedown, collated order. You can also feed single sheets and envelopes manually without removing the paper cassette.

The Blaser Star 2's toner and developer system comes in two pieces. First, you open the left side of the printer and put in the developer unit. You fit the cylindrical toner cartridge inside the developer unit and twist the cartridge 180 degrees to dump the toner into the developer unit. Each toner cartridge lasts for about 3,000 pages. You purchase consumable supplies for this printer in $199, 15,000-page kits that include five toner cartridges, one developer unit, and five waste bottles. The manufacturer rates the Blaser Star 2 at an average monthly duty cycle of 10,000 pages, significantly higher than the more common 3,000 pages. The printer's machine design life is 600,000 pages, which means an average life expectancy of 5 years.

The manual is helpful, with clear illustrations for installation and replacing consumable supplies. Each of the emulations

FACT FILE

Blaser Star 2
Blaser Industries
8300 E. Raintree Dr.
Scottsdale, AZ 85260
(800) 322-3399
(602) 998-0400

List Price: $2,395 with 1MB of memory, $2,195 with 512K
Dimensions (HWD): 10.1 x 15 x 16.3 in.
Weight: 50 lbs.
Emulations: Diablo 630; Epson FX-80; HP LaserJet II
In Short: The Blaser Star 2 has a lot of bang for the buck. The standard machine comes with 1MB of memory, and a nice selection of resident fonts. Blaser's proprietary data-compression facility lets you store lots of text or graphics data in a relatively small amount of printer memory.

CIRCLE **664** ON READER SERVICE CARD

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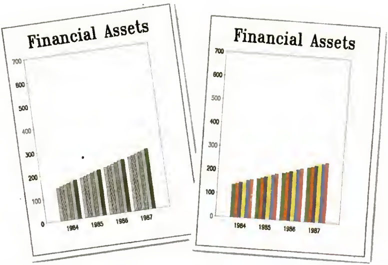

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CIRCLE 348 ON READER SERVICE CARD

*Manufacturer's suggested retail price in U.S.

has its own section in the manual—a useful way of approaching the variety here, since most users will probably use only one emulation. The manual also has an index, a nicety often missing in printer manuals.

The Blaser Star 2's front-mounted control panel includes a 16-character LCD menu screen and eight control buttons. Four of the control buttons are used to scroll through selections in the printer setup menu. The setup menu lets you select printer emulation, manual or automatic feed, interface, number of copies, symbol set, fonts, margins, and number of lines per inch. Settings can be used for the current job only or can be saved as the permanent start-up default, a convenient facility all printers should offer.

The three printer emulations—HP LaserJet Series II, Epson FX-80, and Diablo 630—cover the standard command and control codes for laser printers, dot matrix printers, and letter quality printers respectively. These are the best current choices, and the Blaser Star 2 passed all the compatibility tests we threw at it.

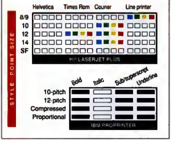
Resident fonts include Courier, Courier Italic, Line Printer, Prestige Elite, Prestige Elite Italic, and IBM PC. Fonts are selected either through the front panel setup menu or by software control codes. There are three cartridge slots on the lower front of the machine that will accept font cartridges, but HP font cartridges will not work in this machine. Downloadable fonts are also available from third-party vendors.

A special feature of the Blaser Star 2 is its data compression facility. According to the vendor, this proprietary algorithm can divide the amount of printer memory a page takes by anywhere from 3 to 32 times, depending on page contents. While the machine tested came with the standard 1MB of memory, a 512K version is available for $200 less.

There's nothing not to like about the Blaser Star 2. Of course, many people prefer the perceived safer (and usually more expensive) route of sticking with the market leaders, but the extra features and aggressive pricing of this unit deserve attention.

The Blaser Star 2 delivers good value for a reasonable price, and its emulations make it versatile indeed. The built-in fonts, relative ease of use, and data compression feature ice the already rich cake.
—Bruce Brown

Brother HL-8



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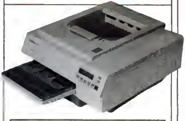

Brother HL-8
Brother International
8 Corporate Pl.
Piscataway, NJ 08854
(800) 284-2744
(201) 981-0300
List Price: $2,695
Dimensions (HWD): 9.1 x 17.9 x 25 in.
Weight: 42 lbs.
Emulations: Brother Twinriter; Diablo 630; Epson FX-80; HP LaserJet Plus; IBM Proprinter XL
In Short: Brother's HL-8 uses the reliable and cost-effective Canon SX laser engine, the same one used in the industry-standard HP LaserJet Series II. The Brother goes HP several better, however, since it includes 1MB RAM, emulates five different printers, and has five resident fonts. The only drawback is that the HP emulation is limited to the LaserJet Plus level.
CIRCLE **663** ON READER SERVICE CARD

Here's a familiar package in a different wrapper. Brother's HL-8 ($2,695) is recognizable by anyone who has seen or used an HP LaserJet Series II. Both printers use the 8-page-per-minute Canon SX laser engine. The performance and reliability of this engine as well as the physical recognition factor start the HL-8 ahead of printers that use other laser engines. The Brother goes Hewlett-Packard one or more better, however, with five built-in printer emulations and five resident fonts.

The 300- by 300-dot-per-inch resolution, toner/developer combination, memory expansion, and font cartridges are interchangeable with the LaserJet Series II, with the exception of the few commands in the Series II that are not supported by the HP LaserJet Plus. The HL-8's one drawback is that it stops one generation short in its HP compatibility, at the LaserJet Plus level. In practice, however, this limitation doesn't matter.

To set up the HL-8, you put the machine on a table, remove shipping restraints and packing materials, and then insert the one-piece combination toner/developer unit. While you probably can find a way to get dirty with this one-piece system, you'd have to work at it.

The Canon SX engine has a rated life of 300,000 pages and an average monthly duty cycle of 3,000 pages. The toner/developer cartridge is nominally due for replacement every 4,000 pages, though practice has shown that judiciously shaking the cartridge redistributes the toner for a longer cartridge life.

The 200-sheet paper cassette fits in the front of the printer. You can adjust the printer to output the pages in either faceup or collated facedown order.

The printer has both parallel and serial printer ports. Its memory can be expanded to a total of 3MB to store multiple-page documents, large graphics files, and/or downloadable fonts simultaneously. The standard 1MB is sufficient to print a single full page of 300- by 300-dpi-resolution bit-mapped graphics.

The HL-8 emulates the Brother Twinriter, Diablo 630, HP LaserJet Plus, IBM Proprinter XL, and Epson FX-80 printers, and there is an easy way to control print

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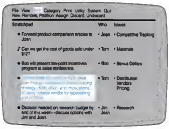

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File  View       Category  Print  Utility  System  Quit
New, Remove, Position  Assign, Discard, Undiscard
________________________________________________________________
Scratchpad                                   Who     Issues

  • Forward product comparison articles to   • Joan  • Competitive Tracking
    Joan

  ♪ Can we get the cost of goods sold under  • Tom   • Materials
    $12?

  • Bob will present ten-point incentives    • Bob   • Bonus Dollars
    program at sales conference.

  • [illegible] week                         • Tom   • Distribution
    with Frid[illegible]ing                          Vendors
    strategy [illegible] and implications            Pricing
    of using outside vendor for typesetting
    and printing

  • Decision needed on research budget by    • Jim   • Research
    end of this week--discuss options with     Joan
    Jim and Joan.
```

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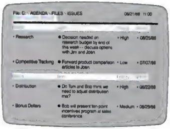

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File: C:\AGENDA\FILES\ISSUES                          06/21/88  11:00
______________________________________________________________________

• Research              ● Decision needed on          • High    • 06/25/88
                          research budget by end of
                          this week -- discuss options
                          with Jim and Joan

• Competitive Tracking  ● Forward product comparison  • Low     • 07/07/88
                          articles to Joan

• Distribution          ● Do Tom and Bob think we     • High    • 06/22/88
                          need to adjust distribution
                          mix?

• Bonus Dollars         ● Bob will present ten-point  • Medium  • 06/29/88
                          incentives program at sales
                          conference
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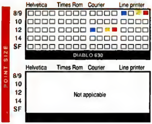
The resident fonts include an 8.3-pitch Brougham font (similar to Courier), 10- and 12-pitch Brougham, 12-point Anelia proportional type, and 16.6 pitch Letter Gothic. Each font can be printed in upright or italic mode, bold or normal, and portrait or landscape orientation.

The Brother's documentation consists of two user manuals, one called the "Technical" manual and the other the "Operate" manual. The Operate manual covers installing and configuring the printer, and the Technical manual provides information for programming the printer or controlling it in the various emulation modes. The manuals have numerous errors in diction and grammar but are nicely illustrated and laid out. They do not have indexes—an aggravating drawback.

The HL-8 meets the HP LaserJet Series II at its own price point but contains more built-in features. Companies that use Brother letter quality printers or the Brother Twinriter printer will also appreciate the Diablo and Twinriter compatibility in the HL-8. This printer doesn't break any new ground, but it is a brand-name option to consider.—**Bruce Brown**

Canon LBP-8IIT



Canon, which helped start the desktop laser printer revolution by building the CX engine used in the original HP LaserJet, also makes the new SX engine used in the LaserJet Series II, as well as a host of other new printers. In addition, Canon sells a number of these engines with its own name on the front: the latest is the $3,950 LBP-8IIT.

Nearly $4,000 for an 8-page-per-minute printer may seem extreme, especially for one that does not offer LaserJet compatibility. You can buy faster printers for half that price. What is the edge offered by the LBP-8IIT?

The answer is a single feature that can have a make-or-break influence on the buying decision, a feature that few other page printers offer. The LBP-8IIT laser printer provides you with two input cassettes, each of which can hold up to 200 sheets of paper.

The advantages are clear. You can put letterhead in one tray, with second sheets in the other. A simple escape command embedded in your file will automatically switch the paper feed as needed. Many word processing programs support the Diablo commands required for this operation, which makes the procedure even easier. This feature also allows you to set up the trays to switch automatically when one empties, so you are able to handle high production volumes without stopping to load paper.

There are other advantages that are clearly secondary to the extra paper bin. One of the most impressive is the LBP-8IIT's forms-printing capabilities. You can define a form in the printer's memory and then select it using the front-panel controls. To demonstrate this feature, Canon includes four forms in the controller ROM. One is an attractive two-line border that edges the page. Another creates lined paper, and a third creates the headings for a fax transmittal page. The fourth, prints "while you were out" message blanks, four to a page. You can print the forms out empty, or you can format the output from your program to fit the blanks. With some clever programming, it is possible to create a *dBASE* application that would allow a receptionist to take phone messages and then print them four at a time onto blank paper. This is done by using the built-in forms capability to print the message blanks on the fly.

There is also the powerful and flexible Canon controller command set. You can get inverse type (white letters on a black background), italic, shaded background, and bold characters on the fly, among other special effects. There is also a powerful graphics command set. Canon should get a prize for having one of the best-looking self-test pages in the business, in which they show off some of the printer's capabilities. While these command sets are not as popular as the LaserJet command set, you will find that many of the top programs offer drivers for Canon laser printers. Canon also runs a free bulletin board service that offers drivers that are free for the downloading.

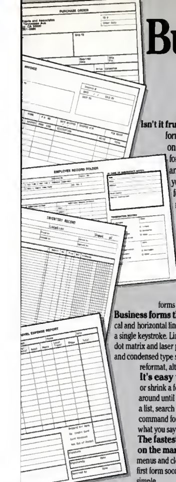
You also get the traditional advantages of the Canon engine: black blacks, easy maintenance with a single toner/developer/photoconductor drum cartridge, and quiet, steady performance.

Still, it is the paper trays that will sell you on this printer. If you need their extra capacity and the flexibility they offer, then the LBP-8IIT is worth a strong look. If not, it is priced out of the race and you will do better to look at the single-tray offerings.—**Alfred Poor**

PC MAGAZINE FACT FILE

Canon LBP-8IIT
Canon USA Inc.
One Canon Plaza
Lake Success, NY 11042
(516) 488-6700
List Price: $3,950
Dimensions (HWD): 12 x 17.75 x 27.25 in.
Weight: 57 lbs
Emulations: Diablo 630
In Short: A niche product, the Canon LBP-8IIT offers the advantages of the Canon LaserBeam printer controller in a laser printer with two paper cassettes.

CIRCLE 653 ON READER SERVICE CARD



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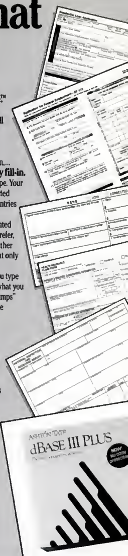

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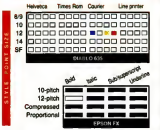
PCM10/31/88

Citizen Overture 110



The page printer market is getting crowded, and the manufacturers are searching for niches to fill that make their product stand out from the crowd. Citizen has certainly succeeded in that goal with the Overture 110; at a list price of $1,995, it is the first 10-page-per-minute machine to duck under the $2,000 price level.

In fact, the Overture, with its Mita engine, did even better than advertised—which is almost unprecendented. Beating the conservative specifications, the printer turned out 10.3 ppm on the PC Labs tests.

The printer does not sacrifice quality for speed, either. It is ruggedly built, rated for an effective life span of 400,000 pages. This is one-third more than the Canon SX-based printers, such as the HP LaserJet Series II, offer. The Overture uses separate toner, drum and developer, and fusing units, so that you can replace the components as needed.

The printer is flexible in its paper-handling options. It has a 250-sheet input cassette, as well as a manual-feed tray that can accept a stack of up to 50 sheets at a time. You can select faceup or facedown output, and the manual feed to the faceup tray provides a straight-through paper path.

The printer comes with a good assortment of fonts, including upright and italic in both 10- and 12-pitch sizes. They are only portrait-mode in the standard machine, although according to a Citizen representative the landscape orientation upgrade is available free from Citizen dealers.

The printer is best suited for text applications. The Epson and Proprinter graphics are coarser than the print engine's 300-dot-per-inch resolution. What's more, both of these emulations encountered difficulties with the PC Labs graphics speed test: there was a horizontal shear part of the way down the page. The printer also has a problem with toner fadeout at the bottom edge of heavy black lines.

The fonts are generally governed by the emulation you select. For example, if you wish to get the PC-compatible high-order graphics characters, you must use the Proprinter mode. If you want italics, you must use the Epson mode.

You choose the emulation mode through the front panel, which is perhaps the weakest part of the Overture's design. It offers only a two-character display, which yields cryptic codes as prompts. You get little feedback from this display as to what the current settings are, or confirmation of when you have successfully made a change. As a result, you must rely on the printer status pages that you can print out using the front-panel controls.

PC MAGAZINE FACT FILE

Citizen Overture 110
Citizen America Corp.
2401 Colorado Ave., #190
Santa Monica, CA 90404
(800) 824-9921
(213) 453-0614
List Price: $1,995
Dimensions (HWD): 14 x 18 x 18.75 in.
Weight: 70 lbs.
Emulations: Diablo 630; Epson FX; IBM Proprinter
In Short: A fast printer that ducks below the $2,000 list price barrier, the Citizen Overture 110 is best suited for settings where you need to produce a lot of pages with relatively little printer sophistication.

CIRCLE 662 ON READER SERVICE CARD

The front panel is also the only means for selecting some of the different fonts. This is not practical in some settings and may pose an unnecessarily difficult challenge to nontechnical users.

> *The Citizen Overture 110 is an attractive value for high-speed, heavy-duty text output.*

The manual offers little assistance in deciphering the front panel use. I had to resort to trial and error occasionally to find out how to make a certain setting stick. The documentation would benefit greatly from some more examples.

The printer comes with both parallel and serial ports, so you should be able to hook it up to your computer without too much difficulty. The only setup problem I encountered involved the paper-feeding mechanism. After failing to get the input tray to feed reliably, I called the technical support number. The response was fast, friendly, and efficient, although the recommended solution was a first for me: sand the printer's soft rubber feed roller with some fine-grit sandpaper. Apparently the roller sometimes develops a hard surface that fails to push the top sheet properly. I am slightly dubious about the diagnosis and prescription, but a light sanding solved the problem, and I had little trouble with paper feeding from then on.

The Citizen Overture 110 does represent an attractive value for settings where you need high-speed, heavy-duty typewritten output. If you need graphics, or if you will need to alter the configuration settings frequently to access different fonts, then it is probably not a good choice. For fast, straight text, it is a speedy and attractive value.—**Alfred Poor**

(continues)

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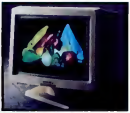

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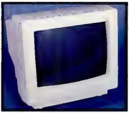

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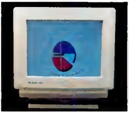

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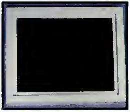

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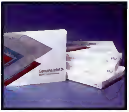

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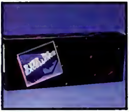

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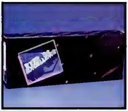

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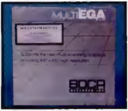

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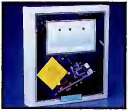

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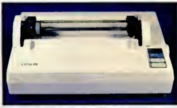

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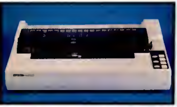

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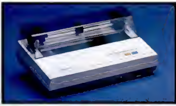

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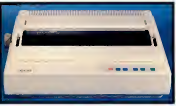

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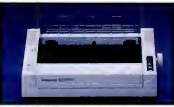

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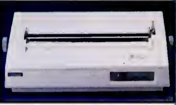

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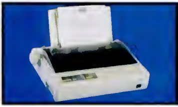

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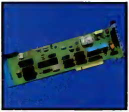

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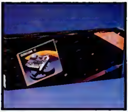

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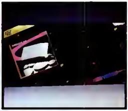

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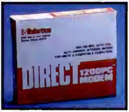

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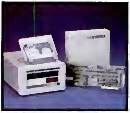

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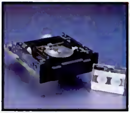

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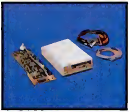

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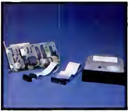

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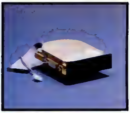

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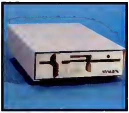

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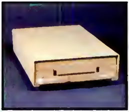

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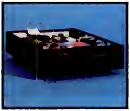

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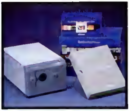

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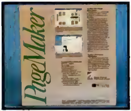

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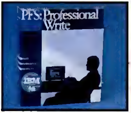

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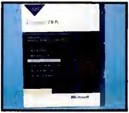

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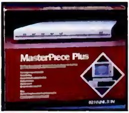

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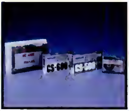

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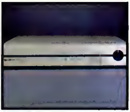

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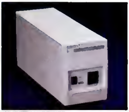

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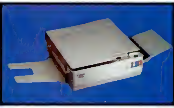

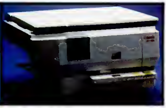

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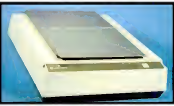

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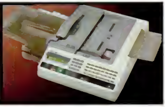

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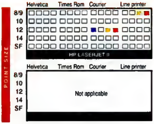
C. Itoh Jet-Setter II



The classic strategies for cloning an established standard are to add functionality or to cut corners. With the Jet-Setter II, C. Itoh has mixed a little of the first strategy with a lot of the second. The result is an HP LaserJet II clone that runs more slowly than the original, offers additional emulations as options, and has a list price of $2,195.

The Jet-Setter II is built around the 5-page-per-minute Konica engine. On the PC Labs speed tests, the printer managed 4.9 ppm. This is relatively slow for a laser printer, but still better than the 1 to 3 ppm that you would get from a daisy wheel or most dot matrix printers in near-letter-quality mode.

The printer does better than average on quality of output. Text is dark, with barely a hint of that fuzziness around the edges that lowers most laser printers to merely copier quality. For graphics output, solid areas are uniformly dark, but patterns don't fare as well, with fine lines much lighter than they should be. Overall, output quality is better than the original LaserJet's but not quite as good as the LaserJet II's.

Very much on the plus side, the Jet-Setter II performed flawlessly for both the text and graphics emulation tests. If anything, the printer emulation succeeds too well, following the LaserJet's limitations as well as its features. Built-in fonts are limited to Courier, Courier Bold, and Line Printer in portrait and landscape modes. Rather than treat boldface and italic as enhancements, the printer requires separate fonts for these features.

Installing the Jet-Setter II is simple enough. You open the printer, drop the corona wire and drum belt into place, and dump the contents of a toner cartridge into the printer's developer unit. The procedure is not only explained well in the user manual but also is illustrated so well that you might not even have to read the instructions.

In an unusual design decision, C. Itoh has chosen to control default settings through DIP switches rather than the front panel, as on most laser printers. The switches are inconveniently located at the back of the printer and consist of two banks of eight switches each.

If you plan to use the printer only for its LaserJet II emulation, the DIP switches won't be a problem: you can set the defaults and forget them. However, if you plan to use the optional emulation cartridges (Diablo 630 or Epson FX-86e plus Proprinter), be aware that the function of some DIP switches changes with different emulations. You may need to get at the switches every time you change emulation.

One benefit of the DIP switches is that using the printer's front panel is trivial.

C. Itoh's excellent manual explains HP control codes and has a convenient foldout that lists commands by type.

The simplistic one-character display has only five error codes—1 through 5—and the explanation of each is listed on the panel. The Jet-Setter II's front panel control is limited to switching on- and off-line, issuing a form-feed, and running a test page. All this is so straightforward that the excellent manual is nearly superfluous.

Paper-handling features are modest. The single paper tray has a capacity of only 100 pages of letter-sized paper. (A legal-sized tray is also available.) You do manual feeds by lifting the cover on the paper tray and placing a page on top of the stack. The Jet-setter's most serious limitation is that it cannot be fed envelopes. As with most recent laser printers, the printer can stack output faceup or facedown.

C. Itoh has included explanations for all HP control codes in the manual. Even better, the manual comes with a quick-reference foldout that lists all commands by type and includes page references for further information. (Other manufacturers, please take note.)

Of course, the ultimate question for this printer is, How much will it sell for in real life? The list price is more than $500 above the street price of the LaserJet II. Clearly, the Jet-Setter II will have to sell for significantly less before it becomes a reasonable alternative to the real thing. A C. Itoh spokesman declined to guess what the street price will be. Stay tuned to your local discount store for further developments.—**M. David Stone**

PC MAGAZINE FACT FILE

C. Itoh Jet-Setter II
C. Itoh Electronics Inc.
2505 McCabe Way
Irvine, CA 92714-6297
(714) 660-1421
List Price: $2,195
Dimensions (HWD): 11 x 29.6 x 16.6 in.
Weight: 67 lbs.
Emulations: HP LaserJet II (with Diablo 630, Epson FX, and IBM Proprinter, optional)
In Short: This straightforward clone of the HP LaserJet II is a little slower than the original and has a list price higher than the street price of the LaserJet II. Assuming that the Jet-Setter II's street price drops proportionately, the printer will be a reasonable alternative to the LaserJet for those on tight budgets.

CIRCLE **643** ON READER SERVICE CARD

The Science of Printing a Page

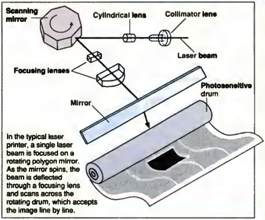
Although laser printers have garnered the lion's share of the page printer market, some competing technologies are starting to find their way into the mainstream. Two of the best-known alternatives are liquid crystal shutter (LCS) page printers and light-emitting diode (LED) array page printers. Both kinds of printers offer the same type of output as laser printers but create the images in different ways, as shown below.

Apart from different methods of charging the drum with a pattern of dots, all page printers operate in a similar way. Toner (the black powder) is transferred to the drum and adheres only to the charged dots. When the paper passes under the rotating drum, the image is attracted to the paper. The paper then passes through a fusing station, where heated rollers press the image onto the paper, actually melting the toner. The charge on the drum is then neutralized and the printing process starts again.

Proponents of the LCS and LED array technologies consider these more reliable since they have no moving parts and are not as susceptible to atmospheric contamination (such as smoke-filled air circulating through the machine) as laser printers are. Also, LCS and LED array page printers do not suffer from the linearity problems that some laser printers have (see "Lasers and Linearity" below). Proponents of laser technology argue that liquid crystals can be affected by heat and humidity—factors that impose limits on the operating environment—and LEDs can burn out. We asked Bob Peckam, marketing manager for LED array printheads at Rohm Corp. (Irvine, Calif.), how long LED arrays will last. He indicated that the life expectancy is 1,000 hours, or 10 million pages.—**Joe Desposito**

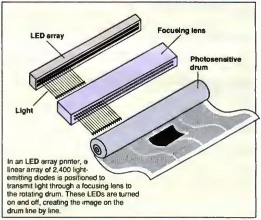
Joe Desposito is the senior project leader of PC Labs.

LASER TECHNOLOGY



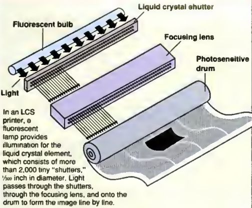
In the typical laser printer, a single laser beam is focused on a rotating polygon mirror. As the mirror spins, the beam is deflected through a focusing lens and scans across the rotating drum, which accepts the image line by line.

LED ARRAY TECHNOLOGY



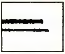
In an LED array printer, a linear array of 2,400 light-emitting diodes is positioned to transmit light through a focusing lens to the rotating drum. These LEDs are turned on and off, creating the image on the drum line by line.

LIQUID CRYSTAL SHUTTER TECHNOLOGY



In an LCS printer, a fluorescent lamp provides illumination for the liquid crystal element, which consists of more than 2,000 tiny "shutters," 1/300 inch in diameter. Light passes through the shutters, through the focusing lens, and onto the drum to form the image line by line.

LASERS AND LINEARITY



Olympia Laserstar 6
(Laser technology)

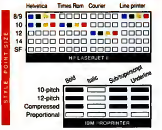
HP LaserJet Plus
(Laser technology)

Qume CrystalPrint Series II
(LCS technology)

NEC Silentwriter LC-890
(LED array technology)

Proponents of the alternative technologies argue that they are more accurate and more reliable than laser technology. Accuracy is assured with either LCS or LED array technology, since both are linear across the width of the drum. In actuality, a laser printer's nonlinearity at the edges of a page is almost indiscernible.

C. Itoh LIPS II



The C. Itoh F-10 Starwriter was one of the workhorse daisy wheel printers in the early days of microcomputers, so it is perhaps only fitting that C. Itoh helps to nail the door closed on daisy wheel technology. At a list price of $3,545, the new LIPS II costs a bit more than much of its competition, but it delivers a lot for the money.

The most important difference between the LIPS II and other page printers in its class is the print engine itself. It has the same 300-dot-per-inch resolution as the others but is faster than most, with a rated speed of 10 pages per minute. It managed 9 ppm in the PC Labs speed tests. The engine is not only faster, but stronger than most. Rated at 600,000 pages, it may have a useful life that is two to three times longer than that of lower-cost machines.

The LIPS II is much easier to set up than other printers; all the print components come preinstalled. You have no drums to scratch, no developer units to drop, no confusing mechanical devices that must be inserted "forcefully but with care to avoid damage." All you have to do is add toner.

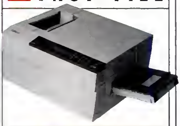
Unfortunately, the toner comes in a tall bottle with a narrow neck. You do not shake the bottle, but instead hold it upside down over the toner bin and "turn it round as you move the bottle from one side of the hopper to the other." The purpose of this maneuver is to distribute the toner evenly in the bin. The actual result is that unless you have a steady hand and plenty of patience, you will probably spill a little toner.

The print quality is excellent, with even coverage and no washout in large areas of dark print. The graphics emulations were generally good. There were some small problems with the dot matrix graphics where a single pixel line would overprint, but these were not frequent or serious. The LaserJet graphics have a tendency to fade out when there are lots of fine lines.

The LIPS II comes with ten different fonts, although when C. Itoh counts all the different symbol sets and combinations, they come up with more than 90. All but one of these fonts are monospace, but there is a Times Roman. The fonts are more useful than those with other printers, however, since the LIPS II can produce bold and italic characters on the fly, effectively tripling the characters available.

As it turns out, not all fonts are readily available with all emulations. You can select the Times Roman font only from the Diablo emulation—the symbol set is not supported by the LaserJet emulation. However, you can select any emulation's font through the front panel.

FACT FILE



C. Itoh LIPS II
C. Itoh Electronics Inc.
2505 McCabe Way
Irvine, CA 92714-6297.
(714) 660-1421
List Price: $3,545 with 512K RAM; $4,595 with 2MB RAM.
Dimensions (HWD): 13.5 x 28.75 x 18.25 in.
Weight: 82 lbs.
Emulations: Diablo 630; Epson FX; HP LaserJet Plus; IBM Proprinter
In Short: The LIPS II is a fast machine built for heavy duty. It comes with a full complement of emulations, a variety of monospace fonts, and a powerful command language built into the controller. This one is best suited for specialized or high-volume applications.

CIRCLE **652** ON READER SERVICE CARD

The front panel is clean and easy to read, with an LCD message window that has two 20-character lines. There is a numeric keypad along with a number of other special function buttons. Through these, you can select emulations, fonts, page layout parameters, and more.

C.Itoh's LIPS II command language provides a nifty Generate Font command.

The LIPS II also has some powerful capabilities in its controller. C. Itoh commissioned the LIPS command language from Office Automation Systems (Oasys), so it bears a close resemblance to the Oasys LaserPro Express command language. You can use the commands to quickly draw all manner of curves, lines, boxes, and other graphic elements. With a single line, you can print any one of 39 different bar codes. You can also control margins and text location.

Perhaps the niftiest feature of the LIPS command language is the Generate Font command. This uses proprietary CIE-FLEX font outlines to generate fonts to your specifications. The outlines include type styles that are similar to Helvetica, Times Roman, Gothic, and Optima. You get to specify point size, compression, rotation, and angle of italic, among other features.

The main problem with the LIPS II is its paper handling. The input cassette holds only 250 sheets, which is typical for most page printers but seems to be a little light when considering a machine for heavy use. The other problem is that there is no manual feed, no faceup output, and no straight-through paper path.

Overall, the LIPS II is a solid printer built for lots of use. It is expensive when compared with the lower-cost machines,

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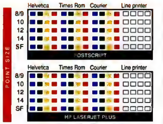
Seikosha
America Inc.

CIRCLE 498 ON READER SERVICE CARD

but gains value from its flexible controller, its faster output, and its heavy duty construction.—**Alfred Poor**

Dataproducts LZR 1260



It's always a pleasure when a printer sets up logically and proceeds to do exactly what it's supposed to do. This is doubly true when "doing what it's supposed to" means printing in PostScript or HP LaserJet Plus mode at 12 pages per minute. So it is with the Dataproducts LZR 1260. And given that the printer is meant to be a shared resource, the list price of $7,995 doesn't even seem expensive.

By far the most impressive feature of this printer is its speed. In LaserJet Plus mode, the text speed measured 11.1 ppm. Results on the graphics speed test were even more impressive, at 82 seconds per page, the LZR 1260 really shines—compared with 130 seconds and up for most other printers.

In PostScript mode, the text speed was slower, at 10 ppm. But in the standard graphics test, the printer spat pages out at 16 seconds per page. And in the PostScript speed test, in which most PostScript printers took 18 or 20 minutes, the LZR 1260 clocked in at a mere 7 minutes, 33 seconds—second to only the Apple LaserWriter IINTX.

Happily, the quality of the output is as impressive as the quantity. Graphics and text are dark and crisp. Graphics patterns retain details, filled-in areas are solid black, and text characters are clean and well-defined, even under a magnifying glass. Although the Courier characters are just a bit thinner than what you would expect from a Selectric typewriter, the overall quality is as good as you'll find in any laser printer.

The secret to the LZR 1260's speed is the same as with the Apple NTX—a 68020 microprocessor. The CPU, plus 4MB RAM, certainly pays off. It's also worth noting that the 35 Adobe fonts are the same as in the NTX. According to a Dataproducts representative, the printer is 100 percent NTX compatible in its PostScript mode. The only practical difference worth noting is that the LZR 1260 provides you with the option of connecting to a parallel port.

Another strong point in this printer's favor is its paper-handling features. Based on the same Toshiba engine as the Toshiba PageLaser12, the LZR 1260 offers the same paper-feed options. A 250-sheet tray is standard, as is the manual-feed slot. An $895 dual-bin feeder, with 250 sheets per tray, brings the total capacity to 750 sheets. A $995 envelope feeder can handle up to 100 envelopes.

A potentially important limitation is that the printer can feed from only two bins in LaserJet Plus emulation, and the envelope bin is not one of them. In PostScript mode you can use any of the bins, either by going through PostScript drivers or by embedding the PostScript codes directly in your document.

Be forewarned that setting up this printer is not a trivial task. One of the complications is that the printer comes in two parts: the 60-pound engine and the 25-pound system unit. From the outside the system unit looks virtually identical to an AT. You have a choice. You can either stack the engine on top of it or mount the unit in a vertical floor stand (a floor stand comes with the printer).

Inside the system unit you'll find the printer controller, room for a hard disk, and room for further expansion by VARs (value-added resellers). The option of a hard disk makes good sense for a shared printer, because it lets you add fonts all in one place. Although the optional disk is not yet available, a Dataproducts representative said the system can already support a 20 to 300MB hard disk, so you can add your own.

Using the printer is far easier than putting it together. Yes and No buttons on the front panel, combined with a 16-character LCD that shows options in conventional English, furnish reasonably intuitive control. If you can't figure out the front panel, you'll quickly find the information you need in the excellent manual.

PC MAGAZINE FACT FILE

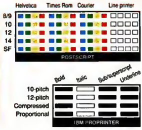
Dataproducts LZR 1260
Dataproducts Corp.
6200 Canoga Ave.
Woodland Hills, CA 91365
(818) 887-8000
List Price: $7,995
Dimensions (HWD): 18 x 19 x 21 in.
Weight: 85 lbs.
Emulations: HP LaserJet Plus; PostScript
In Short: Big, fast, and expensive, the LZR 1260 offers compatibility with the Apple LaserWriter IINTX and the HP LaserJet Plus, as well as heavy-duty paper handling. Recommended for shared-printer needs, this is the one printer to get when you'd otherwise have to get more than one.

CIRCLE **651** ON READER SERVICE CARD

Clearly, this is not a printer for everyone. But if your needs are heavy-duty—particularly for PostScript graphics in desktop publishing, for example—and you must have both PostScript and LaserJet Plus compatibility, the LZR 1260 is the right choice.

Think of it this way: To get the same compatibility with the LaserJet and the NTX and get the same speed for PostScript graphics, you could buy both a LaserJet and an NTX. But that would cost more, and you'd have two slow printers instead of one fast one. I'll take the LZR 1260.—**M. David Stone**

IBM 4216 Personal Pageprinter Model 020



When IBM moves into new territory, it likes to do it with a bang. In an effort to add more weight to its first entry into the PostScript market, Big Blue has dressed up its Personal Pageprinter with the trappings of what it calls the SolutionPac Personal Publishing System—which includes a PS/2, Aldus's *PageMaker*, and *Microsoft Windows*. Yet when you strip the system down to its minimum configuration of the printer, its separate controller board, and the controller software, you're left with a $4,999 package that delivers rather unremarkable performance.

The Pageprinter itself is entirely dumb. A Pageprinter Adapter that you install in your computer handles all PostScript processing—a setup that theoretically speeds up data transfer and therefore printing. At review time only the PS/2 version of the board was available, and IBM provided us with a 20-MHz PS/2 Model 70 to test the system with.

The only controls on the Pageprinter's front panel are an on-line button and a test-print button. The Pageprinter Adapter software handles all other printing functions. When you start the software, it downloads the fully rastered characters of 13 fonts (the standard forms of Times Roman, Helvetica, and Courier) into a font cache. This speeds up printing later on but means that you must wait about 2 minutes for the program to load itself.

You also have an impressive selection of 30 additional fonts. But instead of building the outline forms of these fonts into ROM, as Apple and other printer manufacturers have done, IBM forces you to download them from disk. This requires using a word processor to create a profile file containing the names of the fonts you wish to load. Another drawback is that the Pageprinter Adapter's 2MB buffer restricts you to loading no more than about 15 additional fonts at any one time.

Like most printers, the Pageprinter Adapter rasters the characters of the newly downloaded fonts only at print time and then adds them to the font cache. A nice extra feature lets you save the entire font cache to disk and then reload it later to speed up printing. The software is driven entirely by commands issued at the DOS prompt, which makes it awkward to use but does allow batch files to automate the loading of different fonts.

The Personal Pageprinter also offers IBM Proprinter emulation. While some people may find occasion to use a $4,999 PostScript printer to imitate a dot matrix printer, LaserJet emulation would be much more practical. Another silly touch is the manual's failure to provide any discussion of the Proprinter control codes beyond a curt recommendation to buy the Proprinter manual. Other programming details for the Pageprinter are available only through a programmer's optional reference manual.

> *The Pageprinter Adapter rasters the characters of the newly downloaded fonts only at print time and then adds them to the font cache.*

PC MAGAZINE **FACT FILE**

IBM 4216 Personal Pageprinter Model 020
IBM Corp.
Contact your nearest authorized dealer.
(800) 447-4700
List Price: Personal Pageprinter, $2,199; Pageprinter Adapter/A (PS/2 controller board), $1,950; *Pageprinter Adapter Program*, Version 1.3 (including Adobe PostScript), $850
Dimensions (HWD): 8.5 x 33 x 17.4 in.
Weight: 37.5 lbs.
Emulations: IBM Proprinter; PostScript
In Short: The Personal Pageprinter is controlled entirely by an adapter board and software that you must install in your computer. It offers a huge selection of attractive fonts, but most must be downloaded from disk. And it turned in mediocre performance on our speed tests.

CIRCLE 650 ON READER SERVICE CARD

The printer produces the sharp, clear fonts you'd expect from a PostScript printer, although the characters are slightly less crisp than those of the Apple LaserWriter IINT or IINTX. It also gave us dark, picture-perfect copies of our graphics test files.

When it comes to speed, though, the story is different. Its Ricoh 1060 engine holds the Pageprinter down to 5.6 pages per minute. Connected to a 20-MHz PS/2 Model 70, the Pageprinter required 1,274 seconds to complete our PostScript speed and font tests, while lower-priced competitors such as the Apple LaserWriter IINT and the Qume ScriptTEN turned in faster times running on an 8-MHz AT.

Another one of this printer's weaker areas is paper handling. You can eject pages facedown in a tray on top or faceup in a side-mounted exit tray. The edge of the first page tends to catch when going into the side tray, curling the paper. The printer comes with a single-bin paper feeder and a manual-feed slot. If you want additional paper-feeding options, you're out of luck.

The departures this printer takes from conventional design are more notable for their drawbacks than their advantages. The software that controls all printer functions does offer a degree of extra flexibility, but

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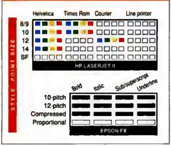
its exclusive reliance on the DOS prompt and batch files is tiresome, and having to download fonts is a needless aggravation. The Pageprinter Adapter board could be forgiven for taking up a slot in your PS/2 if it brought some extra speed to printing tasks, but our testing didn't show this to be the case.—**Robert Kendall**

Kyocera F-1000A



With 79 built-in fonts, 57 pounds of mass, and the ability to emulate seven printers, Kyocera's 9.4-page-per-minute F-1000A belongs in the heavyweight division of LaserJet-compatible printers.

Bells and whistles make the $2,895 F-1000A a worthy choice for a wide range of specialized laser-printing applications, but if you stick close to the mainstream of word processing and databases, you'll find you don't often make use of the bulk of the specialty features. And you'll wish you could have a few strong words with the committee that chose those 79 resident fonts—half of them picked out of a hat, apparently.

In addition to the expected mix of Courier and Line Printer fonts found in any LaserJet Series II compatible, the F-1000A provides elite (12-pitch), Gothic (10-pitch), and mini-lineprinter (21.4-pitch, good for 170 characters across), along with 8- and 10-point Times Roman and 8-point Helvetica knockoffs—all in both portrait and landscape. So far, so good. But there's no 12- or 14-point Times Roman, and the only Helvetica fonts above 8 points are bold and bold italic—no light roman or light italic.

Kyocera builds its own laser printer engines. Operating costs are lower than those of the Canon LBP-SX (HP LaserJet Series II) because you replace the toner (every 3,000 pages) and the printer drum (after 10,000 pages) separately, unlike the case with HP's one-piece cartridges. You do have to be cautious changing toner (pull the safety tab clumsily and you'll cropdust your shirt or blouse). The Kyocera engine is rated at 10 ppm, in contrast with the Canon's 8. Actual throughput is 25 percent faster, 9.4 ppm as opposed to 7.5. Although the Kyocera print quality is good, you will probably find the HP's output slightly better.

The F-1000A has 512K memory (upgradable to 1.5MB), correct-order paper stacking, parallel and serial ports, accurate graphics emulation of the LaserJet Series II and six common dot matrix and daisy wheel printers, and a just-the-facts front panel (on/off-line, form feed, print status sheet, manual feed). The F-1000A allows you to:

■ Load frequently used graphics such as company logos onto plug-in IC cards (they're like font cartridges, only smaller). Two slots are available.

■ Generate bar codes automatically without having to buy special bar-code software.

■ Create specialty type effects using three built-in "Dynamic" fonts. You can stretch, slant, and flip fonts to your heart's desire, although you'd be hard-pressed to think of many *serious* business applications that look like this:

VARIATIONS

■ Switch fonts, printer emulations, or paper orientation, and draw graphics objects (lines, circles, shaded blocks, even simple bar charts) using the robust Kyocera Prescribe command language. You use Prescribe as a supplement or a plain-English substitute for the arcane escape sequences found in the printers the F-1000A emulates.

As with other lasers with built-in fonts, if you tell your software you have an HP and call for an HP font (for instance, Z-cartridge 10 TMS RM), the Kyocera takes its best stab from its internal fonts. Results are usually good, but sometimes justified text doesn't print exactly even at the right margin. Double open quotes (") in *PageMaker* threw off the right margin; the same text printed in *XyWrite* was flawless, but a Ctrl-I tab stop destroyed the right margin elsewhere in the document.

Another quirk: With the LaserJet Series II, if you stick a single sheet (your company letterhead, for instance) in the manual-feed slot, the printer is smart enough to guess your intentions and use the single sheet without requiring special escape codes. The Kyocera isn't.

In PC Labs tests and through several thousand pages of day-to-day use, the F-1000A performed well. Print quality remained good, and there was no sign of the paper jamming that plagued its predecessor last year. If you need Kyocera's pro-

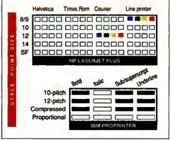
PC MAGAZINE FACT FILE

Kyocera F-1000A
Kyocera Unison Inc.
3165 Adeline St.
Berkeley, CA 94703
(415) 848-6680
List Price: $2,895 with 512K RAM; 1MB RAM upgrade, $495
Dimensions (HWD): 10.5 x 14.5 x 17.5 in.
Weight: 57 lbs.
Emulations: Diablo 630; Epson FX; HP LaserJet Series II; IBM 5152 Graphics Printer; Line Printer; NEC Spinwriter; Qume Sprint 11
In Short: This rugged 9.4-ppm laser printer is 25 percent faster than the HP LaserJet Series II. The English-like Prescribe programming language, built-in hex and bar code printouts, and the ability to burn graphics or specialty fonts into accessory IC cards make the F-1000 good for specialty applications.
CIRCLE 519 ON READER SERVICE CARD

See our all-new 24-pin printers.
OKIDA

grammability, if you need small type sizes to tame big spreadsheets, or if you frequently print documents in landscape mode and want more than HP's two landscape typefaces, the Kyocera F-1000A could be for you.—**Bill Howard**

OAS LaserPro Gold Express



The LaserPro Gold Express, from Office Automation Systems, is the new flagship in the LaserPro line. Priced at $3,895, it is the kind of printer that can confuse a novice or delight a power user. It is most useful as a platform for programmers who need the printer's Express language. If flexibility is what you're looking for, the Gold Express is a good place to start.

In many ways, the LaserPro Gold Express is identical to the Silver Express reviewed last year, the only differences being an extra megabyte of memory and an additional emulation mode.

Standard memory for the Gold Express is 2.5MB. You can also get a 2MB upgrade—to the Pure Gold Express, yielding a total of 4.5MB. The extra memory can be important for those who use full-page graphics and downloaded fonts.

Printer emulations include Diablo 630, Qume Sprint 11, NEC Spinwriter 3550, Epson FX-80, HP LaserJet Plus, and IBM Proprinter. These emulations should cover most software that knows how to use any printer at all, but Office Automation Systems supplies a generic line-printer mode also, just in case.

In graphics emulation tests for the Epson FX, LaserJet Plus, and IBM Proprinter modes, and in text emulation tests for these three plus the Diablo mode, the Gold Express performed without problems. One nice touch is that the printer treats boldface and italic as enhancements, even in LaserJet Plus emulation, so you can use these features even if you don't have a boldface or italic font loaded. Resident fonts include Courier, Elite, Vetica (similar to Helvetica), and two sizes of Line Printer.

Print quality varies somewhat with the emulation. Graphics are generally good, maintaining detail in patterns and filling solid areas with a dark black. The one exception in our tests was in Epson FX emulation, which repeatedly left white specks in solid black areas.

Text quality is more consistent, with no significant differences among emulations. Interestingly, the Gold Express managed slightly better output than the Silver Express in last year's tests. The differences are subtle but real, as confirmed with a magnifying glass. Quality is excellent—barely below that of the LaserJet II.

PC FACT FILE

Office Automation Systems
LaserPro Gold Express
Office Automation Systems Inc.
9940 Barnes Canyon Rd.
San Diego, CA 92121
(619) 452-9400
List Price: $3,895
Dimensions (HWD): 12.2 x 16.2 x 17.5 in.
Weight: 50.6 lbs.
Emulations: Diablo 630; Epson FX-80; HP LaserJet Plus, HPGL; IBM Proprinter; NEC Spinwriter 3550; Qume Sprint 11
In Short: The new flagship in the LaserPro line is of special interest to programmers who can make use of the LaserPro Express language, particularly in concert with the HP plotter emulation for CADD/CAM applications, or with the printer's 2- to 4.5MB memory for desktop publishing.
CIRCLE 649 ON READER SERVICE CARD

On the PC Labs text speed tests, the Gold Express clocked in at 7.1 pages per minute in the Diablo mode and 7.2 ppm in the other modes tested. In the graphics speed tests, it managed 38 seconds in Epson FX mode and 53 seconds in IBM Proprinter mode, but it was slower in LaserJet Plus mode, at 150 seconds.

> *If flexibility is what you want, the LaserPro Gold Express is a good place to start.*

Setting up the LaserPro Gold Express is straightforward. Unfortunately, using the printer is more difficult than installing it because of the obscure two-digit codes in the front-panel display.

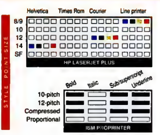
Since the printer comes set to LaserJet Plus emulation, you can immediately use the Gold Express with any software that includes a LaserJet Plus driver. But plan to take time to learn where the definitions of codes are hidden in the manual.

The LaserPro Gold Express will be most appreciated by those who can make use of the Express command language. The language can generate bar codes and fonts. It also includes graphics primitives—boxes, circles, arcs, and fills—that you can use to build graphics or forms with your own programs.

As should be clear, the LaserPro Gold Express should be of most interest to programmers—whether as in-house programmers, consultants, or VARs (value-added resellers). And even for those who can take advantage of the Express language, the LaserPro Silver Express may be all you need. However, if you want the Express language and need the extra memory or the plotter emulation, by all means go for the gold.—**M. David Stone**

See our all-new 24-pin printers.

OAS LaserPro 1510R



Of course it's possible to spend too much for anything, including printers. In the case of the LaserPro 1510R, however, the extra expense gets you practical value, especially when several users share the printer. You get a few emulations with this machine, but its main claim on your budget is speed, speed, speed.

The 1510R uses Ricoh's 4510 laser engine, rated at 15 pages per minute. On our tests it attained a consistent speed of 13.5 ppm, roughly twice the actual speed of most laser printers. Subjectively it feels as if the 1510R is about three times the speed of the 6- or 8-ppm printers.

The cost for that speed is the LaserPro 1510R's $6,495 list price in standard configuration with 768K RAM. That price includes two 250-sheet paper cassettes for the dual-bin system and either a parallel or a serial interface port. The user specifies the port at the time of purchase; this is justifiable given the probable single-location, fixed configuration of this printer. It does seem, however, that for the money they charge for this printer, Office Automation Systems could throw in both interfaces, thus adding flexibility for possible future configurations.

Setting up the LaserPro 1510R is not a task to be taken lightly—at least, with respect to the printer's 110 pounds. Once you've positioned this minimonster, you probably won't want to move it a lot. It has a lot of bulk, but attains most of it through height, measuring 16 inches. Since horizontal desktop space is usually at more of a premium than vertical space, the printer's size is really not a problem.

The two large paper cassettes stack vertically in the front of the printer. The paper goes through the printer in a C path and comes out faceup in reverse order on the top-mounted exit tray.

The printer is built for heavy use, with a 25,000-page-per-month duty cycle and a 1.5-million page printer design life. These usage numbers are five to ten times those of more typical 6- or 8-ppm laser printers.

The busy front panel has a 16-character LCD screen, six buttons, and nine status indicators that light up icons. It uses a system called FRPOs (front-panel operations), through which you control many of the printer's functions. Unfortunately, the FRPO system makes heavy use of two-character commands, such as H9 or A4, rather than taking advantage of the more descriptive indicators that would be possible with 16 characters.

PC MAGAZINE FACT FILE

Office Automation Systems
LaserPro 1510R
Office Automation Systems Inc.
9940 Barnes Canyon Rd.
San Diego, CA 92121
(619) 452-9400
List Price: $6,495
Dimensions (HWD): 16 x 21 x 25 in.
Weight: 110 lbs.
Emulations: Diablo 630; Epson FX-80; HP LaserJet Plus; IBM Proprinter; NEC Spinwriter 3550; Qume Sprint 11
In Short: The LaserPro 1510R is a large, fast printer with many useful emulations. Although it is too expensive for a single user, its 13.5-ppm tested speed is just the ticket for multiuser applications.
CIRCLE 648 ON READER SERVICE CARD

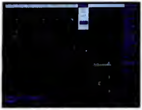
The 1510R's list of standard emulations is impressive; it includes the Diablo 630, Epson FX-80, HP LaserJet-Plus, IBM Proprinter, NEC Spinwriter 3550, and Qume Sprint 11. No emulation incompatibilities surfaced, but in order to make full use of the LaserJet Plus emulation, you must treat the 1510R as if it were an HP. You cannot use Office Automation Systems' Express command language, a proprietary page-description language, to implement all HP commands. For most users this is not a problem; just tell the printer it's a LaserJet and forget it.

The LaserPro 1510R features the Pyramid Font System, which allows modification of its four resident fonts.

Four fonts are memory resident, including roman, Helvetica, Optima, and Gothic. A feature called the Pyramid Font System lets you modify any of these fonts and maintain the mathematical definition of the modification in the printer's memory. Three included diskettes have several downloadable fonts for the HP LaserJet Plus, IBM Proprinter, and Epson FX-80 emulations.

Because of the LaserPro 1510R's cost, buying it doesn't make sense for any but the most speed-conscious single users. Its range of emulations, high-speed printing, and heavy monthly duty cycle make it an ideal machine for sharing by a group. There is no way to plug more than one computer into the 1510R, however, so you either need to use a third-party printer-sharing device (electronic, not mechanical, please, in order to avoid dangerous power surges) or a local area network.

Clearly, the 1510R is a step beyond laser printers designed for single users or for occasional use. This machine is made to take on a crowd and keep up with its demands for a long time.—**Bruce Brown**



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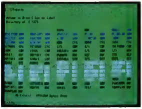

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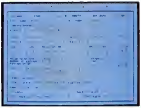
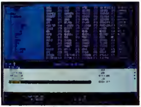
See more on the screen when you write code or review program listings in editors like Brief. 120 × 43 shown.

Change fonts, colors and screen sizes in popular word processors like WordStar & Word Perfect. 80 × 60 shown.



Enhance colors and add fields to any dBASE data entry form. 80 × 43 shown.

See more rows and columns in 1-2-3 or Symphony. Build a 12-month forecast without scrolling left and right.



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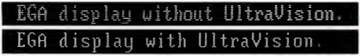
UltraVision looks great on standard EGA monitors, and it gives you even more on autosync displays, like VGA-quality graphics and super high resolution character definition. Give your eyes a break. Your world will look a whole lot better.



EGA display without UltraVision.

EGA display with UltraVision.

These unretouched photos demonstrate how UltraVision improves character resolution on any EGA with autosync monitor. Normal EGA characters are defined in an 8 × 14 matrix versus 9 × 19 for UltraVision.

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UltraVision

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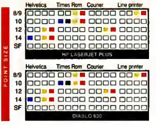
CIRCLE 143 ON READER SERVICE CARD

Olympia Laserstar 6



At $2,699, AEG Olympia's Laserstar 6 is a respectable offering if you are looking for versatility rather than speed in a laser printer. It offers nine fonts accessible in three emulations (Line Printer, Diablo, and HP LaserJet Plus); 1.5MB RAM (expandable to 2MB); and GKS, a popular graphics language. Since the Laserstar 6 is based on the second-generation Ricoh engine, it has a small footprint and a relatively easy assembly process. At under 5 pages per minute for each of its emulations, though, the Laserstar 6 will never win any races.

The LED-based control panel, while more functional than many, is still less intelligible than the LCD panels found on such lasers as C. Itoh's LIPS 10. From the panel you access such features as emulation and font selection, or activate such capabilities as form- and line-feeds. You select landscape or portrait orientation simply by toggling the labeled membrane switch until the LED displays either an L or a P. You can even print out a status sheet that lists the internal fonts and their characteristics, emulation configuration, available RAM, and margin and motion settings.

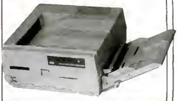
The Laserstar 6 provides for both manual and automatic paper-feed techniques. Because the paper tray adjusts to different sizes, the front control panel sports a dial with seven settings, one of which is for paper of variable size. An optional second paper tray is available and attaches to the bottom, effectively raising the entire printer 3 inches from the desktop. Output comes in collated facedown order on the top of the printer or uncollated faceup order through the back.

Built-in fonts include 10-point Times Roman (upright, bold, and italic), Helvetica, 8-point Times Roman, and 16.6-point Line Printer. Having this variety of fonts is a major plus over the basic HP LaserJet, especially when you consider that the Laserstar lets you orient the fonts in any of four ways, enlarge them, and print them in reverse. If the built-in fonts do not meet your needs, Olympia offers HP-compatible fonts in card format as well as downloadable BitStream-like fonts. The Laserstar 6 can hold up to 32 fonts in its memory at any time.

The Laserstar 6 had no problems outputting any of the graphics or text files in the PC Labs benchmark-test suite. Both the LaserJet Plus and the Diablo emulations worked as expected, albeit slowly. The speed tests rated the printer at 4.7 ppm for text and under 2 ppm for LaserJet Plus graphics.

The quality of the graphics and characters is as crisp as you'd expect from a laser, and most of the enhancements work much as you would predict. For example, the en-

PC MAGAZINE FACT FILE



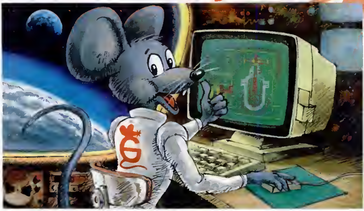
Olympia Laserstar 6
AEG Olympia Inc.
Box 22
Sommerville, NJ 08876
(201) 231-8300
List Price: $2,699
Dimensions (HWD): 8.25 x 16 x 25.75 in.
Weight: 37.5 lbs.
Emulations: Diablo 630; HP LaserJet Plus
In Short: Like the famed tortoise, the Laserstar 6 is dependable but slow. Its many features, including nine fonts and four orientations, make this a printer worth investigating.

CIRCLE 647 ON READER SERVICE CARD

A NEW BREAKTHROUGH IN MOUSE TECHNOLOGY INTRODUCING THE DYNAMIC RESOLUTION

Genius Dyna Mouse

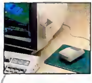
200-800 DPI

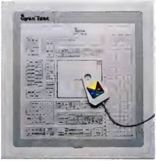


3 DIMENSIONAL DESIGN Contrast to the other Mouse manufacturers' 2 dimensional design, the controls of the Genius DYNA Mouse over the cursor is not only based on the mouse's travel count but also the speed of the mouse's movement. This dynamic resolution may go up to 800 DPI!

GM-6 Plus Include:
- Genius DYNA Mouse
- Genius Menu Maker
- Menu Library
- Dr HALO III
- Genius Mouse Pocket
- Genius Mouse Pad and Cutting Board

GM-ST include
- Genius DYNA Mouse
- Genius Menu Maker
- Menu Library
- Genius Mouse Pocket





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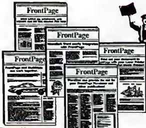
- Operating Mode: MM serial (Summagraphic MM 1201™ compatible). Mouse mode (Microsoft™ Mouse, and PC Mouse™ compatible)
- Lift-up cover sheet allows you to change templates
- Versatility: Works with today's top CAD softwares and almost any kind of menu driven softwares



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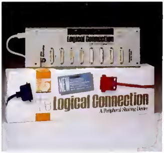
CIRCLE 492 ON READER SERVICE CARD

What's the most logical way to connect everyone to a laser printer?



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$6,950

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Most offices have only one laser printer. So user access can be a real pain. But a Local Area Network can cost twice as much as the printer. And buying a laser for each user is out of the question.

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CHOICE

No wonder *PC MAGAZINE* has *twice* named The Logical Connection its Editor's Choice. In fact, they called it, ". . . more than logical — maybe inspired."

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From Fifth Generation Systems
The makers of FASTBACK and FASTBACK PLUS

CIRCLE 288 ON READER SERVICE CARD

large-character command, one of a number of double-escape code sequences, allows you to alter a font's height and/or width—a capability that can come in handy when creating headlines or letterheads.

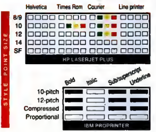
In Diablo mode, the printer throws away the first two columns of a file or a screen dump. While application programs with drivers automatically compensate for this, it is disconcerting when used with programs that simply transmit data much as a screen dump does. To circumvent the problem, Olympia provides the Line Printer mode, essentially a Diablo emulation that maintains the two columns. One nice enhancement to the Diablo implementation is the ability to select any available fonts. This is accomplished by sending one of the double-escape code sequences. (The same sequences also work, but are not documented, in the HP emulation.)

One handy Laserstar 6 feature includes a buffer that prints out a test sheet without destroying the buffer's contents.

The Laserstar 6 has a number of other handy features, including a buffer that lets you print out a test sheet without destroying the contents of the buffer. This can be useful in printing multiple copies of the same page or checking the quality of partially completed output. In addition to the manuals, which are being rewritten, the Laserstar 6 comes with a quick-reference card for front control-panel features.

Despite its tortoiselike speed, the Laserstar 6 is a viable option. The list price may seem high when compared with those of other printers in its class—until you consider the features, the amount of memory, and the number of built-in fonts that come with it.—**Vincent Puglia**

Panasonic Laser Partner



Most page printers must inevitably face comparison with the industry-leading Hewlett-Packard LaserJet Series II. By choosing the same list price of $2,595, the Panasonic Laser Partner seems willing to meet the challenge head-to-head and toe-to-toe. In a bout for the midprice championship, how does this slugger fare?

The predominant strength of the Laser Partner would have to be its variety of features. Rather than blowing the competition away with any one killer feature, it has a dozen of them and can come at you from a number of different angles.

Want print speed? The engine is rated at an impressive 11 pages per minute, well above the others in its price range. In the PC Labs benchmark tests, it managed to hit 10.1—high enough to place it in the top ranks of all tested machines regardless of price.

Want emulations? It has HP LaserJet Plus. Then, to make sure it has you covered, it also gives you Diablo 630, Epson FX, and IBM Proprinter emulations as well.

Need plenty of paper? The Laser Partner will hold a full ream of paper split between two large input cassettes.

How about fonts? Look for extra here, too. You get Courier and Courier Italic in 10, 12, 15, 16.66, and 20 pitch. There is also a Times Roman clone called Century with Century Italic to give you a proportional font. As a bonus, the machine can even create bold versions of the fonts on the fly.

Maybe you are the type who does not want to rely on software and drivers and other incomprehensible esoterica to manage your printer. The full-featured front panel offers almost 20 buttons and an LCD window that keeps you clearly posted on your progress in configuring the machine as you go. There are 4½ pages in the manual that detail all the settings that can be programmed through the front panel.

With all this going for it, what more could anyone possibly want in a printer?

To start with, there is a small problem with the Epson graphics-emulation mode, which caused our test image to be split over two pages instead of printing entirely on one.

Another limitation is the font control. While the controller can create bold characters on the fly, it does so only in certain emulations; the LaserJet emulation is not one of the lucky ones. This means that you need to have a smart HP driver in your

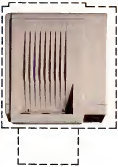
PC MAGAZINE FACT FILE

Panasonic Laser Partner
Panasonic Industrial Co.
2 Panasonic Way
Secaucus, NJ 07094
(800) PIC-8086
(201) 348-7000
List Price: $2,595
Dimensions (HWD): 14 x 28.5 x 16.25 in.
Weight: 71.65 pounds
Emulations: Diahlo 630; Epson FX; HP LaserJet Plus; IBM Proprinter
In Short: The Laser Partner is a midprice page printer in the same perfromance range as the HP Series II, but it offers much more in the way of emulations and other features for the money. It is limited in its paper handling and fonts, however, and this can detract from its overall value.

CIRCLE **646** ON READER SERVICE CARD

Introducing the new Blaser Star 2. The most cost efficient laser printer in its class.

Smallest footprint.
Compare the small Blaser Star 2 17"x18" footprint with the HP LaserJet Series II



Operating costs are vital when selecting a long-term, cost-efficient laser printer. The Blaser Star 2 makes this decision for you by offering the best of both worlds—longer-life consumables at lower prices versus other laser printers in its class.

The Blaser Star 2 toner system also gives you the blackest blacks you've ever seen. Its unique high performance engine technology does more than just emulate the HP LaserJet Series II, Diablo 630, and Epson FX-80. It outperforms them. And this great performance is also available for OEMs.

At only 17"x18" Blaser Star 2 boasts the smallest footprint in the industry. And that's with no protruding trays. The Blaser Star 2 also has full page graphics (300x300 dpi) capabilities. Plus, with our advanced engineering you can do more. More fonts and more forms, up to 128 downloadable.

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CIRCLE 283 ON READER SERVICE CARD

word processor (some have them) to do this or you have to download a corresponding bold font for the printer to use.

More serious, perhaps, is the limited paper handling. The two cassettes are welcome, but they are the only method for feeding paper. There is no manual feed. Likewise, the facedown, collated output is good, but there are times when a straight-through paper path is essential to get a good print on heavy stock or multilayered items such as envelopes. The bottom line is that the extra features do not outweigh the limitations.

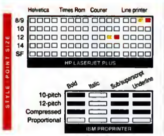
Finally, there is the installation and setup. It starts off all right, with your choice of parallel or serial connectors on the back and all. But when it comes time to add the toner, you are confronted with a large bottle that is topped with a spring-loaded cap. You hold the top open while gently waving the bottle over the toner bin, rolling the bottle back and forth in the air, until all the toner is in the bin.

The Panasonic Laser Partner placed in the top ranks of all tested machines, regardless of price, when it hit the print speed of 10.1 pages per minute.

In sum, the Laser Partner goes for adding features instead of cutting costs. If you are in a high-volume setting where the extra paper and faster print speed are important, then it has some distinct advantages over the competition, and this shows in its bang-for-the-buck measure. On the other hand, if you are looking for a versatile printer with lots of built-in features that will be useful in a wide range of applications, then it loses some of its edge because of its limited paper and font handling.

—Alfred Poor

QMS Kiss Plus 30



If high quality output is the most important feature on your list, then the QMS Kiss Plus 30 should get your attention. Built around the second-generation Canon engine, it offers some of the best text output available.

The QMS Kiss Plus 30 is three printers in one. The $2,195 base engine can't print anything until you plug in one of three functionality cards. The cards contain memory, resident fonts, and emulations, so that depending on which card you pick, you wind up with a substantially different printer.

At the low end, the $495 Functionality Card 10 gives you 512K RAM, 24 resident fonts, and four emulations: Epson FX-80, Qume Sprint 11, Diablo 630, and ANSI. At the next level, the $795 Functionality Card 20 carries 1MB RAM and adds ten additional resident fonts, as well as IBM Proprinter and HP LaserJet Plus emulations. At the high end, the $1,595 Functionality Card 30 has 2.5MB RAM and adds HPGL emulation. For this review, QMS sent us the Functionality Card 30. Add a $130 toner cartridge for a total printer price of $3,920.

On the PC Labs text emulation tests, the Kiss Plus 30 generally performed well, with a few exceptions. The Proprinter and FX emulations ignore the expanded command because the printer lacks an appropriate font. And bold in Diablo emulation looks more like a double strike because the printer offsets the bolding character by only one dot.

The graphics emulations have a few flaws as well. The Proprinter emulation is the worst, with overprints that convert some sections of detailed patterns into solid black. The Epson FX emulation has a similar but lesser problem, with black lines running through some patterns. Happily, there is no such problem on the LaserJet Plus emulation.

On the PC Labs text speed tests, the printer managed a respectable 7.5 pages per minute for all four emulations tested. On graphics, speeds ranged from a low of 75 seconds for Epson FX emulation to about 152 seconds for LaserJet Plus emulation.

Paper handling is a function of the base engine. The Canon SX has a 200-page paper tray, an adjustable manual feed suitable for paper or envelopes, and a facedown output bin. An alternative faceup output tray on the back of the printer lets you feed envelopes and heavy paper using a straight-through path.

PC MAGAZINE FACT FILE

QMS Kiss Plus 30
QMS Inc.
One Magnum Pass
Mobile, AL 36618
(205) 633-4300

List Price: $3,920
Dimensions (HWD): 9.1 x 18 x 32 in.
Weight: 44 lbs.
Emulations: ANSI 6.4; Diablo 630; Epson FX; HPGL; HP LaserJet Plus; IBM Proprinter; Qume Sprint 11
In Short: The QMS Kiss Plus comes in three different flavors, depending on which functionality card you choose. The Functionality Card 30 is the high-end choice, providing the most emulations and the most memory (2.5MB). There's nothing special about the printer, nor is there anything wrong with it.

CIRCLE **642** ON READER SERVICE CARD

OVER THE FOUR-COLOR RAINBOW

It outputs only one page per minute, but the dazzling results of the PostScript-compatible QMS ColorScript 100 are worth the wait.

The QMS ColorScript 100 combines the best of three worlds: high-quality graphics, PostScript compatibility, and full color.

This printer's 1MB of ROM contains 35 resident typefaces and Adobe's Color PostScript Interpreter. Any software that includes Adobe's color driver can output an image to the ColorScript in glorious living color. You can expect drivers to appear in Aldus's *PageMaker*, Autodesk's *AutoCAD* and *AutoShade*, and Micrografx's *Designer*.

Although the printer was not available for a full *PC Magazine* review, I have seen it in action. It's a powerhouse printer designed for graphics-intensive applications.

The ColorScript 100 includes the Mitsubishi G650 engine; RS-232, Centronics parallel, and RS-422/AppleTalk ports; a 20MB hard disk with SCSI interface; 8MB RAM; and 1MB ROM.

PC MAGAZINE FACT FILE

QMS ColorScript 100
QMS Inc.
One Magnum Pass
Mobile, AL 36618
(205) 633-4300
List Price: $24,995. Replacement ribbons, $90 each (four to a box). Ribbon types include black only, three-color (yellow, magenta, and cyan), and four-color (yellow, magenta, cyan, and black).

CIRCLE 661 ON READER SERVICE CARD

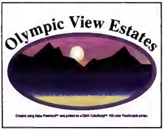
The Mitsubishi engine uses wax-thermal transfer (instead of laser technology) to print an image sequentially in yellow, magenta, cyan, and black at a resolution of 300 dots per inch.

The 20MB hard disk is handy for downloading fonts—permanently. And the 8MB of RAM, used to store a large image file while it's printing, is really a bare necessity.

In order to print a color image, the ColorScript must run the paper past the printhead three or four times. The print speed is therefore determined by how fast the paper moves; QMS claims that a three-color 8½- by 11-inch image will print in just under 1 minute. That is not too bad, but it's not really the speed of an 8- or 12-page-per-minute laser printer, either.

Despite my enthusiasm for this printer, I have a few reservations. If, for example, your pages include lots of black 10-point text, you should definitely get the four-color ribbon. Without it, all of the type must be printed using combinations of yellow, magenta, and cyan. But with it, QMS estimates that you will get anywhere from 20 to 30 fewer printouts per roll. QMS has taken care to achieve

With the printer's 35 resident typefaces and Adobe's Color PostScript Interpreter, the QMS ColorScript 100 is capable of producing intense graphics in beautiful living color. In order to run a color image, the ColorScript engine uses wax-thermal transfer and it runs the paper past the printhead three or four times.


Olympic View Estates
Created using Aldus Freehand™ and printed on a QMS ColorScript™ 100 color PostScript printer.

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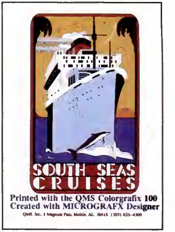
For more information, contact QMS, Inc., 1 Magnum Pass, Mobile, AL 36618 (205) 633-4300


SOUTH SEAS
CRUISES
Printed with the QMS Colorgrafix 100
Created with MICROGRAFX Designer
QMS, Inc., 1 Magnum Pass, Mobile, AL 36618 (205) 633–4300

accurate three-color registration, but you would be foolhardy to try it with small type.

More disturbing to me, however, was the type that printed in black only—I found the quality unacceptable. Evidently the wax was not transferring well to the paper.

By charging $24,995, QMS will surely weed out any potential casual users of the ColorScript 100. (In fact, a *PC Magazine* reader survey showed that only 18.2 percent of potential buyers would be willing to pay more than $5,000 for such a printer.) However, in an environment where color comps, preproduction proofs, or high-impact graphic output is necessary, the ColorScript 100 will prove a valuable tool at any price.
—Luisa Simone

Luisa Simone is an executive editor of PC Magazine.

Printed on a QMS ColorScript™ 100 Printer: The First Color Adobe PostScript® Printer.

The user guide for the Kiss Plus 30 is well written and heavily illustrated. It contains everything you need about setting up the printer and using the control panel, but it suffers from a lack of information on the control codes.

Also be aware that the claim of 34 fonts is slightly misleading. There are only 17 typefaces, each of which can be rotated to landscape mode, giving an effective 34 fonts. A more important hedge is that although all fonts can be made to work in any emulation, not all fonts are supported in all emulations.

In particular, QMS supports only two typefaces in LaserJet Plus emulation: Courier and Line Printer. Other resident typefaces are available only through a superset of non–LaserJet Plus commands, and even then, QMS will not guarantee that those fonts will work. In PC Labs tests, the superset commands succeeded in calling up the additional fonts, but the printer went back to Courier when given the command for boldface.

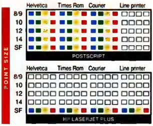
Depending on which of the three functionality cards you choose to use with the QMS Kiss Plus 30, you will wind up with a substantially different printer.

A more important problem with this printer is price. The interchangeable functionality cards mean that if you choose to upgrade, you have to throw out what you already have. But given the rising cost of memory, tossing out a half-megabyte or a full megabyte of memory when upgrading makes little sense.

It's also unfortunate that to get additional emulations, you have to pay for large blocks of memory that you may not need. If you're interested only in text output, for example, you may be perfectly happy with LaserJet Plus emulation and 512K RAM. But to get LaserJet Plus emulation, you also have to pay $300 for an extra half-megabyte of memory.

Overall, the Kiss Plus is less than exciting. It's not that there is anything particularly wrong with the printer; it's just that, except for its Canon engine, there is nothing outstandingly right about it either.
—M. David Stone

QMS PS-810



Since the advent of the PSJet, QMS has been synonymous with excellent implementations of PostScript-based laser printers, and the PS-810 only adds to that reputation. Print quality is excellent, print speed respectable, and functionality enhanced by the inclusion of built-in HP LaserJet Plus, Diablo 630, and HPGL emulations. With a list price of $5,495, the PS-810 is not inexpensive, but the best things in life never are.

Where other printers force decisions upon you, the PS-810 provides choices and power. It comes with three interfaces: AppleTalk, serial, and parallel. It has 2MB of RAM and 1MB of ROM for standard memory, which is more than enough for most print jobs. And if you should decide you need more, it is possible to upgrade with another megabyte of RAM. And its 16-MHz 68000 CPU ensures fast throughput.

Because the PS-810 is based on the new Canon SX engine, it has a small footprint, and its installation is simple and dry-clean free. Its one cassette holds 250 pages and

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*Suggested retail price

DEALERS CIRCLE 746 ON READER SERVICE CARD
CIRCLE 361 ON READER SERVICE CARD

sports paper guides on the top for feeding individual sheets manually. Unlike paper feeds with some other printers, the paper is fed automatically, without any explicit commands to switch from cassette to manual feed. Here you have a choice. Print jobs come out either collated and face-down through the top of the printer or face-up through the back.

As with most other PostScript-based laser printers, the PS-810 lacks a functional control panel. There are LEDs on the front panel that indicate status information such as whether data is being received. However, they do not allow you to control any print-job aspects such as form-feeds (so that you could force a screen-dumped page to be kicked out immediately rather than waiting for it), print orientation, and emulation selection.

Although switching from one emulation to another is as simple as pushing a button, the button's location—at the back of the printer alongside the ports—leaves much to be desired. Fortunately, a menu-driven utility called PS Executive lets you set parameters, such as bit-per-second rate and handshaking, and switch between emulations. While QMS charges $150 for the software, some dealers provide the PS Executive disk free with the printer. Needless to say, the software is indispensable for someone who frequently switches between PostScript and LaserJet Plus emulations.

FACT FILE

QMS PS-810
QMS Inc.
One Magnum Pass
Mobile, AL 36618
(205) 633-4300
List Price: $5,495
Dimensions (HWD): 9 x 18 x 26 in.
Weight: 44 lbs.
Emulations: Diablo 630; HP LaserJet Plus, HPGL; PostScript
In Short: The PS-810, the first PostScript laser based on the Canon SX engine, offers flexibility and power in its emulations of the popular printers. It's expensive but definitely a known and reliable quantity.

The PostScript implementation is superb, providing all 35 fonts found in the Apple LaserWriter II. As with the LaserWriter, you are able to enhance, rotate, or size any of the fonts. And, the Diablo emulation is fairly straightforward and did not present any problems during its usage and testing.

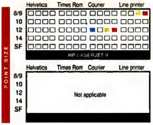
The LaserJet Plus emulation is limited to the Courier, Helvetica, and Times Roman fonts; however, you can orient, size, and enhance all of them at your discretion. This ability to fine-tune your fonts provides you with much more versatility than a LaserJet, whether right off the shelf or upgraded with downloadable or cartridge-based fonts. According to one of the PC Labs benchmark tests, an earlier version (Version 47.0A) of the printer's firmware was unable to properly output a full-page, bit-mapped graphics file generated by the *Microsoft Windows* LaserJet Plus driver. QMS has rectified the problem in their newest release (Version 47.2B) of the firmware. You should be aware, however, that the problem does not appear in the PostScript implementation.

Despite the overhead required by running the emulations through PostScript, the PS-810 is respectfully fast, outputting text at a tested 6.7 pages per minute. It is capable of outputting the full-page PostScript graphic in approximately 16.5 minutes, and the full-page bit-mapped graphic in 148 seconds.

The manual describes the rudiments of the PostScript language and gives appropriate instructions and commands for installing the printer for various cables, protocols, and bps rates.

The PS-810 may not be the fastest PostScript laser reviewed in this issue. Nor is the location of its emulation selector convenient. Nevertheless, it offers more than the minimum in features and capabilities, and its manufacturer is both respected and responsive.—**Vincent Puglia**

Qume CrystalPrint Series II



Money isn't everything, but it is hard to turn down a bargain. At a list price of $1,999, Qume Corp.'s CrystalPrint Series II is one of the first page printers to offer HP LaserJet Series II emulation for a list price of less than $2,000. This fact alone makes it an interesting product.

Another feature sets this printer apart from most of the competition, though it is much harder to see: this is not a laser printer. Like a laser, it uses a photosensitive drum and a toner to print a page at a time. But instead of using a laser and a rotating mirror, it uses a bright halogen light that shines through a matrix of LCD cells that open and shut to expose the page image on the drum.

The CrystalPrint was originally manufactured by Data Technology Corp., but Data Technology purchased Qume earlier this year and acquired that company's name.

The printer is easy to set up and maintain. It comes with separate toner, developer, and photosensitive drum components. You are supposed to replace the developer unit after three charges with toner, and a little counter on its case keeps track for you. The drum should be replaced after every 10,000 pages, which is approximately after every fifth toner charge.

The CrystalPrint comes with a complement of fonts similar to those of the HP LaserJet Series II. You get Courier, Courier Bold, and Line Printer in both portrait and landscape orientation. There are also four different symbol sets with each font, giv-

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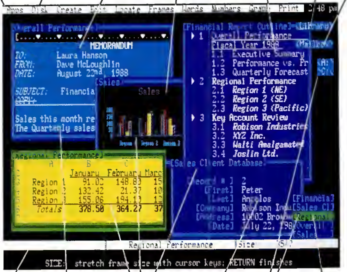

```
[Overall Performance]
MEMORANDUM
TO:       Laura Hanson
FROM:     Dave McLoughlin
DATE:     August 22nd, 1988
SUBJECT:  Financia
COPY:
Sales this month re
The Quarterly sales

[Regional Performance]
              A          B         C
                  January  February Marc
   Region 1       91.02    148.83   15
   Region 2      132.42     21.37   10
   Region 3      155.06    194.13   12
     Totals      378.50    364.27   37

[Financial Report Outline]=[Library]
▶ 1  Overall Performance
     Fiscal Year 1988
     1.1  Executive Summary
     1.2  Performance vs. Pr
     1.3  Quarterly Forecast
▶ 2  Regional Performance
     2.1  Region 1 (NE)
     2.2  Region 2 (SE)
     2.3  Region 3 (Pacific)
▶ 3  Key Account Review
     3.1  Robison Industries
     3.2  XYZ Inc.
     3.3  Walti Amalgamated
     3.4  Joslin Ltd.

=[Sales Client Database]
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      [First]  Peter
       [Last]  Angelos
    [Company]  Robison Indu
    [Address]  10002 Brow
       [Date]  July 22, 198

[Financial]
[Sales Cl]
[Regional]
[Overall]
[Sales]

Regional Performance      Size     (5/7)
SIZE:  stretch frame size with cursor keys; RETURN finishes
```

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On the other hand, which by now makes three hands, it's also a great communicating tool. The word processor has features as advanced as any top-of-the-line program. Like a built-in thesaurus. And an 80,000-word spell checker that checks your spreadsheets, too. There's also electronic mail to communicate with your workgroup without ever leaving Framework.

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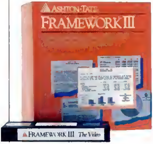

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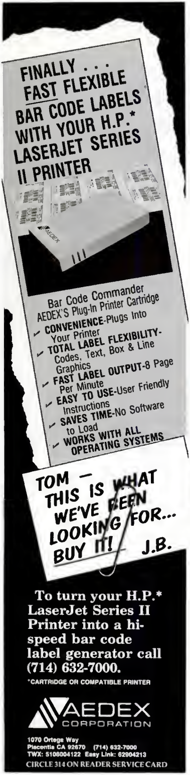

ing you access to high-order ASCII characters for foreign languages and the PC character set.

Despite its lower price and powerful emulations, though, this printer has some flaws that detract from its overall appeal.

To begin with, its physical design limits its flexibility. The input paper tray holds only 100 sheets, a small number by almost any current standard. There is only one paper path—facedown—at the top. The paper follows an S with two tight turns, making it difficult for heavier paper stock to make it through without a jam or a wrinkle. There is no straight-through path option to circumvent this problem. After all this, it should come as no surprise that the CrystalPrint offers no means for feeding envelopes or manual sheet feeding.

The CrystalPrint Series II also has a performance drawback. Rated at 6 pages per minute, it turned in a consistent 5.8 ppm in the PC Labs text speed test. Most printers rated at 8 ppm typically produce at least 7.5 ppm, making them about 30 percent faster than the CrystalPrint Series II.

PC MAGAZINE FACT FILE

Qume CrystalPrint Series II
Qume Corp.
500 Yosemite Dr.
Milpitas, CA 95035
(800) 223-2479
(408) 942-4000
List Price: $1,999
Dimensions (HWD): 9.0 x 15.75 x 14.75 in.
Weight: 35 lbs.
Emulations: HP LaserJet Plus
In Short: The CrystalPrint Series II offers an attractive price for a printer with full LaserJet Series II emulation and several monospaced fonts. But physical and performance limitations reduce its overall value, making it an interesting yet unexceptional alternative in the page printer market.

CIRCLE 657 ON READER SERVICE CARD

The CrystalPrint Series II deserves credit for providing LaserJet Plus emulation for under $2,000.

The front panel controls are not particularly flexible, and the two-character display shows only cryptic message codes. The printer's documentation, clear and well written for setup procedures, falters when trying to explain the front-panel operation.

The CrystalPrint II does accept some optional attachments. For example, cards insert into two slots on the front of the machine to add more fonts or other printer emulations. The computer comes with 512K of memory, with the single option of upgrading to 1.5MB in one step. This contrasts with other similar printers that can go as high as 4.5MB.

The print engine used in the CrystalPrint is not as rugged as those of many competing printers. According to Qume, it is rated for an effective life of only 180,000 pages—equivalent to 36 cases of paper.

The CrystalPrint Series II produces crisp and solid characters and images. It deserves credit for getting below $2,000 for LaserJet Plus emulation and does offer some useful expansion options.

Its limited paper handling, slow performance, and confusing front panel detract from its overall value, however. By the time you get to comparing street prices, even its price advantage will probably dwindle, leaving no compelling reason to consider this printer over some of its faster and more flexible competitors.

—Alfred Poor

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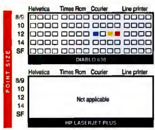
Qume CrystalPrint WP



Qume's CrystalPrint WP is another new printer that has broken new ground in the page printer price wars. It is the first machine to drop through the $1,300 price line. Lower in cost than many daisy wheel printers, this page printer lacks many of the features you might expect to find. But you still have a fast and quiet printer that's perfect for some users' needs.

Like the more expensive CrystalPrint Series II, the WP model uses the Casio LCS print engine. This is based on a bright halogen light source (like a car headlight) instead of a laser to expose the photosensitive drum. The light is screened by a 300-dot-per-inch liquid crystal cell matrix in which each cell acts as a miniature shutter to transmit or block the light as needed for each dot on the printed page.

There are pros and cons to this design as compared with laser engines, but in any event it is hard to tell the difference by looking at the output. The CrystalPrint WP produces pages with a crisp, clean Courier typeface that looks every bit as good as competing print.

You can get a few different print effects such as bold or underlined text using the Diablo 630 command set. This is the only emulation mode in the machine, although you can get upgrades that add IBM Proprinter, Epson FX-85, or HP LaserJet Plus emulation. Without these upgrades, however, you get no graphics; this is simply a daisy wheel equivalent that prints typewritten text quickly and quietly.

The engine is rated at 6 pages per minute and managed to achieve a respectable

EDITOR'S CHOICE

FACT FILE

Qume CrystalPrint WP
Qume Corp.
500 Yosemite Dr.
Milpitas, CA 95035
(800) 223-2479
(408) 942-4000
List Price: $1,299
Dimensions (HWD): 9.0 x 15.75 x 14.75 in.
Weight: 35 lbs.
Emulations: Diablo 630; HP LaserJet Plus, $248.
In Short: The CrystalPrint WP is the least expensive page printer yet, costing less than many daisy wheel printers and outperforming them handily. Its limited fonts and lack of graphics make it compare less favorably to the more expensive alternatives, but it is worth considering if you need a text-only printer.
CIRCLE **656** ON READER SERVICE CARD

5.8 ppm in the PC Labs benchmark tests. This is at the low end of most page printers, but it's lightning fast compared with the output rates of impact printers.

The CrystalPrint WP is easy to set up. The components have color-coded labels to help insert Tab A into Slot B. The manual is written in a slow-paced and easy style, supported by plenty of illustrations, so that the most naive user should still feel fairly comfortable about assembling the printer.

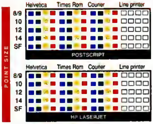
A few problems arise, the most glaring being the paper tray. One might assume that a text-only printer would be designed for heavy use in an office environment, but the CrystalPrint WP's paper tray holds only 100 sheets. Other handicaps include no manual feed, no straight-through paper path, and no way to feed envelopes.

The printer is rated for only 180,000 pages for its life span, another limitation to its usefulness in a heavy production environment.

The front panel presents still another problem. The two-character display does not convey much information, and the manual lacks an adequate explanation of how to set the printer using the front panel. You will want to change the front panel settings for many applications, too. Unless you set the Diablo emulation for ECS (Extended Character Set), for example, you cannot access the high-order ASCII foreign-language character set.

The CrystalPrint WP is a low-priced wonder, but keep in mind the price you pay to keep the costs down. Compared with other page printers, it is slow, limited in fonts and paper handling, and it cannot do graphics. While it can be upgraded, you would probably be better off buying something else from the start if you need those features. Compared with a daisy wheel model, however, it wins walking away. If you are looking for a good text printer and don't need much more, this may be the one.—**Alfred Poor**

Qume ScripTEN



A bargain among PostScript printers is a bit of a contradiction in terms. It's true that PostScript printers cost about twice as much as other page printers, but if you need PostScript, you need to look at the Qume ScripTEN.

This printer was the only one in its class to come in with a list price of less than $4,500. You might expect that this buys you a stripped-down system, but nothing could be further from the truth.

FACT FILE

Qume ScripTEN
Qume Corp.
500 Yosemite Dr.
Milpitas, CA 95035
(800) 223-2479
(408) 942-4000
List Price: $4,495
Dimensions (HWD): 15.5 x 28.25 x 17.5 in.
Weight: 90 lbs.
Emulations: HP LaserJet Plus; PostScript
In Short: Perhaps the best bargain among PostScript printers, the ScripTEN combines a rugged 10-ppm engine with a list price under $4,500. A full complement of typestyles and excellent LaserJet Plus emulation add to its appeal.
CIRCLE **655** ON READER SERVICE CARD

To start with, the ScripTEN boasts a full complement of Adobe PostScript typestyle outlines: 11, all but 3 of which include upright, bold, italic (or oblique), and bold italic (or bold oblique) versions. To make certain that you have enough room to work with these fonts, the ScripTEN's controller comes with 3MB RAM as a standard feature.

The print engine is a rugged Hitachi unit. Qume claims a standard 300,000-page life for the system, but it appears built with more substantial components than other printers with the same rating. The unit tips the scales at a hefty 90 pounds.

The ScripTEN is rated at a slick 10 pages per minute, and in PC Labs testing it clocked 8.2 ppm on the speed test in PostScript mode. Note that this time was ob-

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CIRCLE 325 ON READER SERVICE CARD

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CGA	640x200	16/64
MDA	720x348 640x400	
LINES OF TEXT		

[illegible]	132x25	132x44	[illegible]	[illegible]	[illegible]	[illegible]
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CIRCLE 540 ON READER SERVICE CARD

tained after the printer had already created the required fonts; the same test run immediately after power-up resulted in only 6.8 ppm because the controller had to take time to create the characters from the PostScript outlines.

Ample flexibility is built into this muscle. There are three ports on the back: Centronics, serial, and AppleTalk. A ten-position rotary switch configures the interface. You can select between emulations (PostScript and LaserJet Plus) and the connectors. Some combinations allow the serial port to run at either 1,200 or 9,600 bits per second.

You get the output only facedown, in proper sequence in an output tray at the top of the unit. You do have a choice of methods for paper input, however: the cassette holds 250 sheets, or you can use a manual-feed slot.

It may appear a bit curious, but the HP LaserJet Plus emulation is becoming a standard feature for many PostScript machines. The ScripTEN implements this feature with powerful results; it runs the LaserJet commands through the PostScript controller, enabling the printer to do some interesting tricks. For example, since the PostScript part of the controller can create the required fonts on the fly, you can specify just about anything you want in LaserJet commands, and it will appear on the page. I was able to create test prints with fonts from 2 to 40 points.

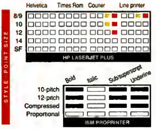
The ScripTEN does have a few areas that could be improved. The paper handling is handicapped without a straight-through paper path that would permit the use of heavier or multisheet paper.

Although I never encountered any problems in the course of the PC Labs testing, Qume warns about possible complications when running in LaserJet mode. For example, the character widths are not quite the same as on a true LaserJet. More ominous perhaps is the warning printed on a separate yellow sheet, stating that "when using *Ventura Publisher* in LaserJet mode, downloaded fonts can be lost during complex download operations." There is even a short PostScript program that you are supposed to key in and run when changing from PostScript to LaserJet.

My only other criticism is that the engine is a little more difficult to set up than are some others, perhaps as a result of its more solid construction.

Overall, the ScripTEN is fast and relatively inexpensive considering that it is a PostScript printer. If you have already decided that you need what PostScript has to offer, the ScripTEN may offer you more for less.—**Alfred Poor**

Sharp JX-9300



Everyone's getting into the act. Sharp's JX-9300 is yet another good quality, competitively priced laser printer. By itself it's not exciting except for its multiple emulations. But the JX-9300, at $2,195, constitutes a good example of the quality you can get for just over $2,000.

The JX-9300 is a rated 6-page-per-minute printer with the standard 300- by 300-dot-per-inch maximum printing resolution. The machine actually tested faster than its rating, attaining an average speed of 6.1 ppm.

Both parallel Centronics and 25-pin serial interfaces are standard, as is facedown, collated paper output. An optional $15 faceup paper tray is available. Paper can be fed manually, but usually it comes from the single letter-sized 100-sheet-capacity cassette. A legal-sized paper cassette costs $41 extra. Standard RAM is 512K with a 1.5MB expansion option available for $699.

The Sharp has several standard emulations. It can emulate the HP LaserJet Plus, Epson FX-80, IBM Graphics Printer, IBM Proprinter, and Diablo 630. You'll be hard-pressed to find PC-based business software that won't run on at least one of those emulations. About the only type of output missing is HP plotter emulation or color printing.

After speed and printer emulations, the next-hottest question is built-in fonts. Fortunately, the JX-9300 has the same standard fonts as the HP LaserJet Plus. Unfortunately, that means only two: Courier and Line Printer. This is the one area where Sharp should beef up this machine. HP doesn't include more fonts, so it falls on the shoulders of competitors to supply more in every category. An additional three or four fonts could make a world of difference, at least in perceived value.

This printer uses a three-piece system for replaceable supplies, with a separate photoconductor drum ($215 and good for 30,000 pages), developer cartridge ($119 and 10,000 pages), and toner cartridge ($58 and 5,000 pages). The various components slide easily into the printer.

FACT FILE

Sharp JX-9300
Sharp Electronics Corp.
Sharp Plaza, P.O. Box 650
Mahwah, NJ 07430
(201) 529-8200
List Price: $2,195
Dimensions (HWD): 12.5 x 16.25 x 16.5 in.
Weight: 38.6 lbs
Emulations: Diablo 630; Epson FX-80; HP LaserJet Plus; IBM 5152 Graphics Printer, Proprinter
In Short: Sharp's JX-9300 isn't particularly fast, and it comes standard with only Courier and Line Printer fonts, but it has the five most significant printer emulations, 512K RAM, and an aggressive price.

CIRCLE **654** ON READER SERVICE CARD

The front-mounted control panel uses membrane buttons, seven LED indicators, and a two-character LED status screen. Besides overseeing normal paper handling, the control panel sets number of copies, paper size, portrait or landscape printing orientation, a backup feature, hex dump, printer interface, and emulation and emulation-specific settings such as character sets, pitch, and emphasized print. Its two-character setting codes are more primitive than those that appear on the 16-character LCD screens that many other printers use, but that's not a problem if you don't mind looking at the manual once in a while.

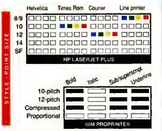
> *The JX-9300 has a three-piece system for replaceable supplies. Each component slides easily into the printer.*

The JX-9300's backup feature is helpful. It solves the specific problem caused by paper jams during long print jobs. With many laser printers you would lose the page in memory during the reloading process. The Sharp's backup function prevents such a nuisance by holding the page contents in memory until it has been successfully printed.

The JX-9300 works well, and it comes at a reasonable price, as laser printers go. It's competing with a tough crowd. While the Sharp gives up a bit in font versatility and standard memory, it is a winner in its selection of printer emulations. Unfortunately, while multiple emulations make reviewers smile—and certainly expand the market for this printer—once you've purchased the JX-9300, you probably will use at most two emulations. That's when you'll want more fonts. Sharp does have a series of proprietary format font cards, but it would be nice to have a couple more fonts as a standard feature.

—Bruce Brown

Star Micronics LaserPrinter 8



It's become easier to fall into a "quantity trap" when evaluating printers. Is "more" worth more, and just when is "more" enough? That's the dilemma you might feel when you look at the $2,799 Star Micronics LaserPrinter 8. While the printer will never earn an originality award for its name, Star Micronics has surrounded the Canon LBP-SX engine with quite a bit. But it has also tacked on a price tag that, at first look, may seem too high.

In the plus column you'll find 1MB RAM standard and an additional 1MB available as a $399 option for graphically intense environments. You won't need a letter opener to fumble around with DIP switches when you want to set options. An LCD panel allows you to program everything from emulations to the vertical-motion index command. You can set the options for immediate action only or as power-up defaults, and if you manage to fumble everything into insensibility, you can reload the factory options.

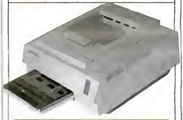
The only problem with this panel is that the buttons used to select the "next" and "previous" options from a series of choices are reversed. The Next button is the left of two, with its arrow pointing left, while the Previous button is the rightmost of the pair, and its arrow points right. Some other mysteries arise as well.

The IBM Proprinter emulation (one of four emulations supplied) is correct down to the appearance of IBM's high-order characters; it ran the PC Labs Proprinter emulation test without a hitch. But, when it came time to run the graphics speed test, the LaserPrinter 8 apparently developed a consistent graphical hiccup about one-quarter of the way down the page. It lost about a quarter of the remaining graphics imaging and finished up with the last half unevenly tacked on to the beginning.

The parallel port also had problems. While both serial or parallel communications are standard, the parallel port on the evaluation unit stubbornly refused to listen, even after both the Centronics and IBM parallel interface options were tried (our PC worked with another parallel printer).

All isn't gloom, of course. As you can see in the Printer Guide samples, the print quality of the LaserPrinter 8 is quite dense. And, fortunately, Star Micronics has not gone the route of some other manufacturers and supplied the printer with "dotty" dot matrix emulation printing. Everything is solid and crisp, wringing a no-compromise text printing speed of 7.4 pages per minute from a laser engine with an upper limit of 8 ppm.

PC MAGAZINE FACT FILE



Star Micronics LaserPrinter 8
Star Micronics America Inc.
200 Park Ave.
New York, NY 10166
(212) 986-6770
List Price: $2,799
Dimensions (HWD): 9 x 15.5 x 19.5 in.
Weight: 45 lbs.
Emulations: Diablo 630; Epson EX-800; HP LaserJet Plus; IBM Proprinter
In Short: The LaserPrinter 8 joins the crowd of "me too" laser printers. It is an honest machine, fulfilling its performance promises, but it is undistinguished among its peers and simply adds to the multitude of choices already available.

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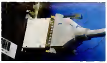

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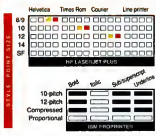
CIRCLE 490 ON READER SERVICE CARD

Start-up time is a dream as well. Like all printers using LBP-SX engines, the LaserPrinter 8 sports a single cartridge containing both drum and photoconductor. Installation takes only about 3 minutes. And warm-up is startlingly fast. I have become accustomed to a leisurely stroll to the coffee machine while waiting for the old Canon engine powering my QMS PS-800 to warm up—but the LBP-SX engine, rated at under a minute, is ready about 30 seconds after I hit the power switch.

The LaserPrinter 8's $2,799 suggested retail price is unimpressive. It would be easy to fall in love with the LaserPrinter 8 for $2,300, or at least to remain faithful at $2,500. Had Star Micronics ignored the Epson EX-800 emulation and substituted PostScript, an even higher price tag would be no problem.

The LaserPrinter 8 is undeniably a competent printer. Several other competent printers are equally deserving. It would take some better distinguishing features or a great deal on the price to make this printer really stand out in the crowd. The Canon engine is a big plus for the LaserPrinter 8, but in today's crowded market, people want more.—**Bill O'Brien**

Tandy LP 1000



The Tandy LP 1000 laser printer proves that "good enough" is often all you need. For a list price of $2,599, the LP 1000 offers compatibility with the IBM Proprinter and Wheelprinter, HP LaserJet Plus, and Tandy's own DMP 2110 data processing and word processing command sets.

On PC Labs text and graphics emulation tests, the LP 1000 performed without problems. In IBM Proprinter mode it responded as ordered to commands for bold, compressed, superscript, subscript, and expanded text. Alas, it ignores those commands in HP mode, following the LaserJet's limitation of requiring a separate font for each enhancement.

With some logic, the printer uses IBM high-order characters only when in Proprinter or Wheelprinter modes. When in LaserJet Plus mode, it uses the HP LaserJet high-order characters (Roman 8). And in Tandy DMP it uses yet another high-order character set (the Tandy set).

One noteworthy improvement on the LaserJet is that the LP 1000 includes Century PS and Prestige Elite fonts in addition to Courier and Line Printer fonts. You can call these up with the appropriate HP commands.

Also worth mentioning is a BitStream soft-font disk that emulates HP cartridges B and F and contains Dutch (the equivalent of Times Roman), Swiss (the equivalent of Helvetica), and OCR-B fonts. According to a Tandy spokesman, the disk is now bundled with the printer, but early printers were shipped without it. If you buy the LP 1000, check to make sure the disk is there, since Tandy will not supply it otherwise.

Many of the LP 1000's good and bad points grow from its use of the Ricoh 1060 engine. Good points include relatively small size and light weight. Bad points include a relatively slow engine speed and a meager 150-page paper capacity. Unlike some other printers, however, the LP 1000 wrings everything it can from the engine.

With a rated speed of 6 pages per minute for the Ricoh engine, the LP 1000 managed 5.9 ppm in LaserJet Plus mode and 5.8 ppm in Proprinter mode. In the graphics test it managed just over 122 seconds in LaserJet Plus mode and about 62 seconds in Proprinter mode. Compare that with 177 seconds for LaserJet Plus mode and 75 seconds for Proprinter mode for the 12-ppm Toshiba PageLaser12.

Quality of output is also surprisingly good. In general, output quality for the Ricoh 1060 falls somewhere between that of the first-generation Canon engine (in the original HP LaserJet), and the second-generation Canon engine (in the current HP LaserJet II). The LP 1000 lives up to this expectation for graphics, but does better than expected for text.

For graphics output, the printer maintains complex patterns well enough but produces a less-than-solid black for large filled-in areas. For text it produces crisp, dark characters that rival the second-generation Canon engine in quality.

The manual for the LP 1000 is better than most other laser printer manuals. Very much on the plus side is that it contains both a list of the commands for each emulation mode and explanations for each command—something that is missing from far too many laser printer manuals.

The control panel is filled with bizarre icons that are anything but clear. For example, the power-on indicator is a zigzag lightning bolt that looks for all the world like a paper jam. Two single-character LEDs issue cryptic error codes, menu numbers (menus 1 to 9 plus A and B), and the item numbers within each menu.

At a price that recently went up from

PC MAGAZINE FACT FILE

Tandy LP 1000
Tandy Corp.
1800 One Tandy Ctr.
Fort Worth, TX 76102
(817) 390-3700
List Price: $2,599
Dimensions (HWD): 8 x 24 x 16 in.
Weight: 37.5 lbs.
Emulations: HP LaserJet Plus; IBM Proprinter, Wheelprinter; Tandy DMP 2110
In Short: The LP 1000 offers Proprinter and LaserJet Plus emulation in a Ricoh engine, at a measured speed of 5.9 ppm. Although it was an attractive package at $2,199, it looks less so at $2,599. Still, the relative value may change as other printers also raise their prices to meet the rising cost of memory.

CIRCLE **641** ON READER SERVICE CARD

Discounting Price

4.77/10 MHz
8088 BASED SYSTEM

STANDARD FEATURES:

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STANDARD FEATURES:

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- ☐12 MHz with zero/one wait state motherboard. Motherboard accommodates up to 4MB onboard RAM using 80NS 1 MB dram's
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- ☐Samsung amber monochrome monitor
- ☐200 watt power supply
- ☐1.2MB high density floppy drive
- ☐Hercules compatible monochrome adapter card
- ☐1 parallel port
- ☐1 serial port
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DISCOUNT MICRO

BASE SYSTEM $1171

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is not enough...

20 MHz WITH ZERO WAIT STATE.
386/20 SYSTEM

STANDARD FEATURES:

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- ☐16/20 MHz W/ zero wait state. Motherboard accommodates up to 4MB onboard RAM
- ☐200 watt power supply
- ☐Enhanced 101 key keyboard
- ☐AT style case with LED's for hard drive, power, and turbo setting
- ☐1.2MB high density floppy drive
- ☐Samsung amber monochrome monitor
- ☐1 Parallel port
- ☐1 Serial port
- ☐1 Game port
- ☐Hercules compatible monochrome adapter card
- ☐HD/FD controller
- ☐OS/2 compatible
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EGA SYSTEMS:

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LASER PRINTERS: THE HIDDEN COSTS

You might as well buy a laser printer because in the long run, the cost of its operation will be just about the same as for a dot matrix printer, right? Take a look.

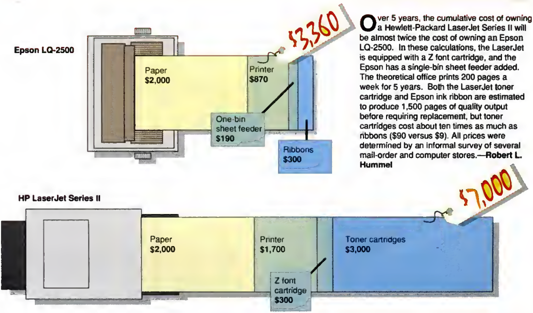
Because the PC industry is relatively young—and so much of the technology used in today's printers is even younger—no hard data on a printer's productive lifetime and long-range cost per page exists. To fill this gap in our knowledge base, I did some completely unscientific, seat-of-the-pants research to determine the true cost of using a printer in a typical office.

Because there is really no such thing as a typical office, much less a typical printer or a typical printer user, feel free to interpret these results with a jaundiced eye. But until more solid data develops over the years, this analysis should serve to give you a rough feel for the cost of owning and using a printer.

The printers considered for this analysis had to meet several criteria. First, they had to be suitable for normal office use. This includes considerations such as size, noise level, and appearance. Second, they had to be able to print a "letter quality" letter. This simply means it shouldn't look like a Western Union Mailgram. Finally, they had to be able to print on standard 8½- by 11-inch letterhead. Based on these criteria, I narrowed the comparison down to two common and pervasive technologies: impact printing (24-pin dot matrix) and nonimpact printing (laser).

Of course, choosing these two printer types doesn't mean that other printers can't be used in an office or produce

Laser Technology vs. Dot Matrix: The Cumulative Cost over 5 Years



Over 5 years, the cumulative cost of owning a Hewlett-Packard LaserJet Series II will be almost twice the cost of owning an Epson LQ-2500. In these calculations, the LaserJet is equipped with a Z font cartridge, and the Epson has a single-bin sheet feeder added. The theoretical office prints 200 pages a week for 5 years. Both the LaserJet toner cartridge and Epson ink ribbon are estimated to produce 1,500 pages of quality output before requiring replacement, but toner cartridges cost about ten times as much as ribbons ($90 versus $9). All prices were determined by an informal survey of several mail-order and computer stores.—**Robert L. Hummel** quality printing. That's for you to decide. I'll simply try to provide a peek at what you can expect in the way of cost of ownership. Our two representatives will be the Hewlett-Packard LaserJet Series II and the Epson LQ-2500.

For the purpose of this analysis, we'll assume that both types of printers will survive paper clips, coffee spills, and everything else that goes along with the office environment (including competition from newer models) for 5 years. At the end of this period, the capital cost of these printers should be completely depreciated.

The cost of printing a page has many variables, and a complete analysis would fill many pages. For simplicity, I've divided them into three categories: necessary, unnecessary but unavoidable, and unwanted. Among the necessary variables are paper, ink, and the purchase price of the printer itself. The analysis of each printer must include these items, because they determine the majority of its operating cost.

Unnecessary but unavoidable are printer accessories; these include font cartridges, downloadable font packages, sheet feeders, printer-sharing devices, hardware spoolers, and networks. Once the initial cash outlay for the printer has been justified, the desire for these time- and money-consuming accessories seems to swell beyond reason. Some people turn into instant "printer power users" and never recover.

UNWANTED COSTS The unwanted costs of owning a printer are many. Printers with a single paper tray make shuffling company letterhead and plain bond a continual chore. If you try to save time by mixing the two in one stack, the printer will rebel by pulling two sheets through at once, misprinting the entire stack. Threading printed tractor-feed forms can consume a lot of time and forms, especially if there's no clear registration mark to align the printhead. Likewise, removing the tractor-feed margins (perfetti) from letters before passing them on can require a substantial expense of time.

The first step in calculating the cost of printing is to define the amount of use a printer is subject to in our mythical office. Assume a medium use of the printer with approximately 200 printed sheets produced in a typical week. Assume 50 weeks of use each year. Over a 5-year period, this amounts to 50,000 printed pages.

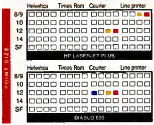
Based on an informal survey of *PC Magazine* editors and other corporate staff located here, I established the average life of a laser toner cartridge to be about 1,500 pages. A letter-quality printer ribbon for the Epson LQ-2500 prints about the same number of pages but costs significantly less. The chart shows the total cumulative cost of operating both printers over the 5-year period. The costs of common accessories deemed essential have been added.

It's plain to see that operating either printer is an expensive proposition, and that even though the LaserJet costs almost twice as much as the LQ-2500, the cost of the printer itself is a relatively small portion of the total life-cycle cost. With that in mind, it may be to your advantage to purchase a faster or more rugged faster printer even though the initial cost may be higher. After all, you're going to be living with it for a long time.
—Robert L. Hummel

Robert L. Hummel is senior technical editor of PC Magazine.

$2,199 to $2,599, the LP 1000 seems expensive compared with the alternatives. Still, inasmuch as this increase is due to the increased cost of memory chips, combined with a 1.5MB base memory, it's likely that the competition will raise prices similarly. If so, the LP 1000 will remain a reasonable choice.**—M. David Stone**

Taxan Crystal Jet

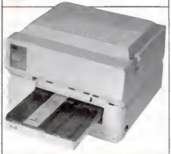


The Taxan Crystal Jet, part of a complete desktop publishing system including high-resolution monitor and scanner, comes with a standalone list price of $3,495—a solid notch above the other non-PostScript, 8-page-per-minute page printers. For this price you would expect to get some impressive bonuses, and at the start you would not be disappointed.

Open the Crystal Jet binder, and you will find ten disks. There is a utility disk that helps you configure the system, and another disk of downloadable soft fonts. There are also three disks to install *BitStream Fontware* in *Microsoft Windows*, and another pair to install the same program for *Ventura Publisher*. There are two disks that include the outlines for the acclaimed BitStream Charter type family. Finally, there is a disk with a program called *Crystal Control*. The Crystal Jet comes with 2MB RAM as standard equipment.

BitStream Fontware is a fantastic program that (given time) can create downloadable HP LaserJet fonts in almost any size you wish, while creating screen fonts for favorite WYSIWYG applications such as *Windows* or *Ventura Publisher*.

FACT FILE



Taxan Crystal Jet
Taxan USA Corp.
18005 Cortney Ct.
City of Industry, CA 91748
(800) 544-3888
(818) 810-1291
List Price: $3,495
Dimensions (HWD): 15 x 19.25 x 26 in.
Weight: 66 lbs.
Emulations: Diablo 630; Epson FX; HP LaserJet Plus; IBM 5152 Graphics Printer; NEC Spinwriter; Qume Sprint 5
In Short: Part of the Crystal series of desktop publishing peripherals, the Crystal Jet makes a disappointing showing as a standalone product. Flawed emulations, limiting design, slow performance, incomplete and confusing documentation, and weak support overpower the attractive bonuses of *BitStream Fontware* and other handy extras.

CIRCLE **640** ON READER SERVICE CARD

Crystal Control is a custom version of Insight Development Corp.'s *Laser Control 100*, a program that gives LaserJets the ability to emulate Epsons, Diablos, Qumes, and the like.

The Crystal Jet is based on the Casio LCS engine, which uses a bright halogen light and a matrix of LCDs as shutters to create an image on a light-sensitive drum (like Qume's new page printers). At 300-dot-per-inch resolution, the printed output looks crisp and dark—equal to all but the best of the competition.

Unfortunately, the Crystal Jet's flaws and limitations abound. The first problem lies in the interface. Rather than use a standard parallel interface, the printer has a custom video interface that takes up a slot in your PC. I encountered a conflict with an Intel AboveBoard in the PC AT I was using. Instead of resolving it, I had the luxury of being able to simply yank the memory card for the time being, but someone planning to live with this printer on an extended basis would have to do some reconfiguring to get rid of the problem.

Another shortcoming of the custom interface approach is that you cannot share the printer easily. According to a Taxan representative, you can use a standard parallel printer switch, but since this is not documented anywhere in the manuals, I would recommend that you get this detail confirmed directly by Taxan before buying the switch.

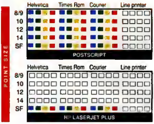
The whole advantage of the custom interface rests in performance—the computer can pump data through to the printer faster. Unfortunately, despite its 8-ppm rating, the Crystal Jet couldn't do better than 4.1-ppm—placing it dead last in the speed department. The only place where the interface showed any possible advantage was in the printing of HP LaserJet graphics.

While setting up the printer for the first time, I ran into two glitches—one typical and one not so typical. The first was that after I had managed to configure the printer correctly, it would not print any pages. I could get a test pattern from the engine itself, but nothing from the computer.

The second problem stems from the fact that the Crystal Jet's emulations are offered by *Crystal Control*, which loads into memory and intercepts the print stream so it can translate it on the fly. When you try to invoke the program without loading the memory-resident shell first, however, the Crystal Jet exhibits a quality-control breakdown in that the error message tells you twice to issue an LCSHELL command; the correct command is CCSHELL.

Even if it were competitively priced, the Crystal Jet would have an uphill fight on its hands. Perhaps Taxan has been torpedoed by trying to include 2MB of memory at today's inflated rates. Whatever the cause, this printer will have a tough time at its present price point; there are too many better values for $1,000 less. Perhaps the Crystal Jet has some hidden advantage when teamed with its supporting cast in the Crystal series, but as a solo act it gets the hook.—**Alfred Poor**

Texas Instruments OmniLaser 2106



	Helvetica	Times Rom	Courier	Line printer
8/9	🟦🟩🟨🟥	🟦🟩🟨🟥	🟦🟩🟨🟥	☐☐☐☐
10	🟦🟩🟨🟥	🟦🟩🟨🟥	🟦🟩🟨🟥	☐☐☐☐
12	🟦🟩🟨🟥	🟦🟩🟨🟥	🟦🟩🟨🟥	☐☐☐☐
14	🟦🟩🟨🟥	🟦🟩🟨🟥	🟦🟩🟨🟥	☐☐☐☐
SF	🟦🟩🟨🟥	🟦🟩🟨🟥	🟦🟩🟨🟥	☐☐☐☐

POSTSCRIPT

	Helvetica	Times Rom	Courier	Line printer
8/9	☐☐☐☐	☐☐☐☐	☐☐☐☐	☐☐☐☐
10	☐☐☐☐	☐☐☐☐	☐☐☐☐	☐☐☐☐
12	☐☐☐☐	☐☐☐☐	☐☐☐☐	☐☐☐☐
14	☐☐☐☐	☐☐☐☐	☐☐☐☐	☐☐☐☐
SF	🟦🟩🟨🟥	🟦🟩🟨🟥	🟦🟩🟨🟥	☐☐☐☐

HP LASERJET PLUS

If you believe that the hallmark of good design is to give flexibility to the user, then you will certainly appreciate the Texas Instruments OmniLaser 2106. A PostScript printer at heart, this Rich Little of laser printers offers near-perfect imitations of several command sets. At $4,595, it's not a bargain-basement item, but PostScript printers never have been cheap.

The emulations in the OmniLaser 2106 include Diablo 630, HP LaserJet Plus, HPGL, and Texas Instruments' own TI-855—which itself emulates the Epson MX-80 and the Qume Sprint 11. It would be hard indeed to find a program that doesn't support at least one of these command sets.

In the PC Labs emulation tests, the 2106 responded appropriately in all of them. In general, the 2106 limits itself to those features that are available in the printer being emulated. However, there are some exceptions. For example, the LaserJet Plus emulation lets you use LaserJet commands to choose among 12 fonts, rather than limit you to the two that are built into the LaserJet Plus.

As a PostScript printer, the 2106 closely matches the Apple LaserWriter IINTX. It has nearly the same set of 35 built-in fonts, except that TI substitutes the four Helvetica Condensed fonts (standard, bold, oblique, and bold oblique) for the equivalent Helvetica Narrow fonts. Since PostScript calls fonts by name, this means that a driver designed for the LaserWriter II will generally work with the 2106, except when calling on those four fonts. Be aware that the 2106 lacks the IBM high-or-

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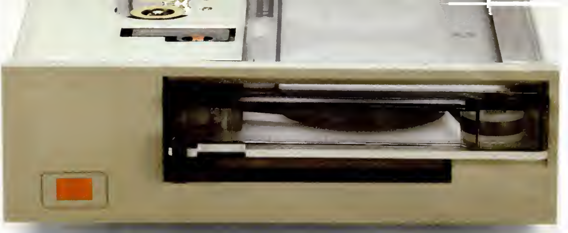

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der character set: TI chose to match the high-order characters on the LaserWriter instead.

Graphics emulation is also good. The 2106 worked without problems on the PC Labs graphics speed tests for PostScript, HP LaserJet Plus, and Epson MX-80.

The 2106's flexibility extends to its hardware interface. The printer offers a choice of Centronics parallel or RS-232, RS-422, and AppleTalk serial connections. Interestingly, you can connect the printer as parallel, then connect a second cable to the RS-422 connector to get messages from the printer for interactive PostScript.

As with most laser printers, the 2106 can use the front-panel controls to set typeface, hardware and software interface, paper-input tray (standard or optional), paper size, and other parameters. However, unlike most laser printers, the 2106 responds in English rather than in obscure codes, by way of a two-line by 16-character LCD.

Claimed speed for the printer is 6 pages per minute. In PC Labs tests, the measured speed for text ranged from 5.4 ppm for LaserJet emulation to 5.6 for Diablo emulation. In the standard graphics speed tests, the speed ranged from well over 200 seconds for LaserJet Plus emulation to a respectable 39 seconds for PostScript mode. Alas, in the PostScript speed test, the 2106 managed only a slow 22 minutes, 33 seconds.

The manuals are another plus. Installation instructions are well written and heavily illustrated to get you started with minimum bother. A reference manual conveniently lists and describes the commands for each of the printer's personalities.

The weakest aspects of the 2106 come from the underlying engine. Print quality

PC MAGAZINE EDITOR'S CHOICE

- **Apple LaserWriter II**
- **Brother HL-8**
- **Qume CrystalPrint WP**
- **Toshiba PageLaser12**

The laser printer market has a new low end, thanks to the amazing Qume CrystalPrint WP, a $1,299 liquid crystal shutter machine that produces 6-page-per-minute, laser-quality output more affordably than any other printer. If you had any doubts about the death of the daisy wheel, take a look. Remember, though, that the WP in this printer's moniker stands for "word processing" and nothing else. There is no graphics capability, no varied typefaces, no fonts (nor even compressed type). Nevertheless, the CrystalPrint heralds a new era of inexpensive, easily accessible laser-quality output. Look for lots of competitors in the near future.

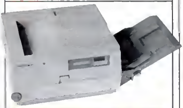
The best competitor in the HP LaserJet look-alike category is the $2,695 Brother HL-8. It performed the PC Labs graphics speed test more quickly than most others, and its Canon engine—the same one as in the LaserJet Series II—produces the sort of quality we've all come to expect from that fine machine. With 1MB RAM, five standard emulations, and five standard typefaces, the HL-8 is more versatile than the LaserJet; it's a real high-performance bargain. Don't forget about the HP LaserJet itself, however. It's a year and a half old now, but it's still holding up well to assaults from would-be competitors. With its street price plunging below $2,000, don't ignore the LaserJet as you shop among its competitors.

For speedy printing and *extraordinary quality, the Toshiba PageLaser12 is the clearest choice we've seen in a long time. At $3,799 it sounds expensive, but its 11.4-ppm throughput, wide-ranging emulation abilities, and blacker-than-black printing make it a clear winner in this year's crowd.*

The big-bucks PostScript market is still owned by Apple. Make no mistake about it. There are would-be competitors from Texas Instruments and IBM, but the LaserWriter II (in either its 68000-based NT configuration or its 68020 NTX configuration) is so powerful and quick, and its Canon SX engine base so good, that there's no real choice here except between the $4,599 NT and the faster, more-expandable $6,599 NTX.

Honorable mention goes to the gigantic Dataproducts LZR 1260. At $7,995, complete with its own controller (and room for a hard disk) in a PC box, this 10-ppm monster is far too big for a single user but would be a proud addition to many local area networks.

PC MAGAZINE FACT FILE



Texas Instruments OmniLaser 2106
Texas Instruments Inc.
P.O. Box 181153
Austin, TX 78718
(800) 527-3500

List Price: $4,595

Dimensions (HWD): 7.7 x 32 x 16 in.

Weight: 13 lbs.

Emulations: Diablo 630; Epson MX-80, HP LaserJet Plus, HPGL; PostScript; Qume Sprint 11; Texas Instruments TI-855

In Short: As a PostScript printer, the OmniLaser 2106 is a close match to the Apple LaserWriter II. Its multiple emulations and multiple hardware interfaces are a strong plus where flexibility is an issue.

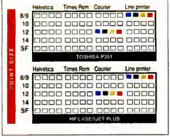
CIRCLE **639** ON READER SERVICE CARD

on the Ricoh 1060 is equivalent to a good xerographic copy. It is simply not in the same class as the second-generation Canon engine in the LaserJet II. There is also a sense of flimsiness about the engine, as well as a questionable design choice in leaving the drum exposed in a place where it can be touched accidentally while fixing a paper jam.

Another shortcoming is that the standard paper tray will take only 150 sheets—though an optional 250-page tray is available to fit under the printer. On the plus side, the Ricoh engine results in a relatively small box: it's only 16 by 16 inches with the optional paper tray (or 16 deep by 24 wide with the standard-input paper tray).

The OmniLaser 2106 does not represent a price/performance breakthrough. But if you need a PostScript printer and can also make use of the wide range of emulations, the 2106 should be on your list of possibilities.—**M. David Stone**

Toshiba PageLaser12



The Toshiba PageLaser12 is the kind of printer that will redefine your expectations. Whatever feature you consider to be most important, odds are you'll find it here. And although the list price of $3,799 is steep when compared with that of many other non-PostScript lasers, it seems reasonable indeed considering what this printer can do.

The printer exudes quality and ruggedness from the first step of installation. The Toshiba engine requires separate installation steps for the toner bottle, drum cartridge, developer cartridge, and fuser. As forbidding as that sounds, the installation is neither difficult nor messy. The pieces fit together with an authority that speaks of careful quality control.

To its credit, Toshiba has provided excellent instructions. The manual is filled with good-quality photos that will take you through each step. The first time through, expect to spend at least 45 minutes—most of it reading. Having installed the pieces once, however, you'll have no trouble remembering how to do it next time, so that replacing consumables is trivial.

Whatever feature that you consider to be the most important, odds are that the Toshiba PageLaser12 will have it.

The rest of the documentation is just as good. The user manual describes the basics of operation, maintenance, and troubleshooting. The technical reference manual contains the commands for each of the printer's emulations. This is noteworthy since so many manufacturers charge extra for this information.

The three built-in emulations in the PageLaser12 are the IBM Graphics Printer, Diablo 630, and Toshiba's own P351 (which is based on the Qume Sprint 11). Also standard is an emulation for the HP 500 Plus, provided on a cartridge the size of a credit-card calculator. The emulation-cartridge slot offers the potential for developing additional emulations, though Toshiba says that none are planned at this writing. The printer also has two font-cartridge slots.

On the PC Labs text-emulation tests, the PageLaser12 performed without problems in all cases. A nice touch added to the HP 500 Plus emulation is the ability to boldface and italicize any font in the printer, rather than requiring additional fonts for each enhancement.

The PageLaser12 also did well on the graphics emulation. Using IBM graphics mode with the Proprinter test, the output was marred only by a few lines of overprint, or bleeding. These are visible only within patterns and are caused by the conversion from Proprinter resolution to laser printer resolution. No problem arose with the HP graphics emulation.

Output quality on both text and graphics is superb. Text is dark enough to resemble an original rather than the "good copy" quality of most laser printers. The printer's graphics maintain intricate patterns and unusually crisp, dark blacks for solid areas.

On the PC Labs speed tests, the PageLaser12 rated an impressive 11.4 pages per minute for the HP and the P351 emula-

PC MAGAZINE EDITOR'S CHOICE

FACT FILE

Toshiba PageLaser12
Toshiba America Inc.
Information Systems Division
9740 Irvine Blvd.
Irvine, CA 92718
(714) 583-3000
List Price: $3,799
Dimensions (HWD): 12.6 x 18.8 x 19.4 in.
Weight: 84 lbs.
Emulations: Diablo 630; HP 500 Plus; IBM 5152 Graphics Printer; Toshiba P351
In Short: This heavy-duty laser printer offers high-quality output, a measured speed of better than 11 ppm, and excellent paper-handling options. If your word processing needs are heavy—up to 25,000 pages per month—this is your printer.

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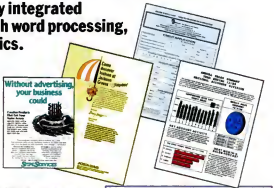

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- **GEM User Interface:** It's fast and easy. Pull-down menus, icons, scroll bars and dialogue boxes help you learn and use the program quickly. Your display screen shows you exactly what your final product will look like when you print—***What-You-See-Is-What-You-Get.***
- **Flexible Page Layout:** With your mouse or joystick, and keyboard, you can overlap, reposition, resize, & reshape the text, columns, graphics. Change your layout or experiment almost effortlessly!
- **Built-in Fonts:** Choose from over 1200 possible type-style combinations! Opt for bold, italic, underlined, white, light, & superscript or subscript characters. Type sizes range from 7 to 72 point.
- **Premium Quality Printouts:** *PUBLISH IT!* uses a special high density printout format that gives you superior quality printouts on your dot matrix printer.
- **Built-in Word Processor:** All the features necessary for everyday word processing, plus most of the sophisticated ones found only in more expensive programs.
- **Text Importing:** Load documents from WORD PERFECT, MICRO-SOFT WORD, WORDSTAR, WORD WRITER PC, or from any other program with an ASCII text format directly into *PUBLISH IT!**
- **Built-in Graphic Toolbox:** Draw lines, boxes, circles, curved corners, and "free-hand" graphics. Plus, choose from a wide variety of built-in line and fill patterns.
- **Kerning and Leading**
- **Graphics Importing:** Directly import graphics from LOTUS 1-2-3, GEM DRAW, GEM GRAPH, GEM SCAN, PC PAINT-BRUSH, and PUBLISHERS PAINTBRUSH.* Then crop and size them to fit.
- **Automatic Text Flow and Word Wrap:** Flows text from around graphics: and from column to column on the same page, or carries it over to subsequent pages.
- **Multiple Size Page Views:** View, edit and layout pages at actual, double or half-size.
- **Over 150 Professionally Drawn Graphics & Illustrations.**
- **Plus, you get worksheets, time-saving features, sample documents & more!**

Includes 5¼" & 3½" disks; supports hard drive.

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312-948-9200

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CIRCLE 248 ON READER SERVICE CARD

tions. It was slightly slower in its other modes, but still more than 11 ppm. On the graphics tests, it managed an unimpressive 75 seconds for IBM graphics mode, and nearly 180 seconds for HP mode. This is a slower test result than the graphics speed of some printers using the 6-ppm Ricoh engine.

If your word processing needs are heavy duty—up to 25,000 copies per month—Toshiba's PageLaser12 is the clear winner where lesser lasers won't do.

The menu controls for setting options on the PageLaser12 are another plus: they're so obvious that you should never need the manual. A set of Display Options buttons is labeled Prev. and Next. A second set of Change Value buttons is also labeled Prev. and Next. To change an option, you use the first set of buttons to find the option, then use the second set to find the value you want for that option. That's all you need to do.

Yet another advantage of the PageLaser12 is its paper-handling ability. The printer comes with a single 250-page cassette that goes in the front of the printer; there's a manual-feed slot at the rear. A $999 dual-bin addition adds two more 250-page cassettes. And for envelopes, a $999 feeder fits on the back of the printer to hold 100 envelopes. Finally, to facilitate collating your output, a $299 "jogger" is available.

Clearly, the Toshiba PageLaser12 is not for everyone. But if your word processing needs are heavy—up to the recommended maximum of 25,000 copies per month—the Toshiba PageLaser12 is the clear winner where lesser lasers won't do.
—M. David Stone

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The PC Magazine Printer Guide: Dot Matrix Printers

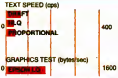
ALPS Allegro 24

24-pin
$499

Paper size

LET	LEG	

Sound level
69 dB

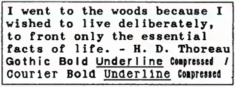


FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Gothic Bold Underline Compressed /
Courier Bold Underline Compressed

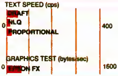
ALPS ASP1000

9-pin
$299

Paper size

LET	LEG	

Sound level
77 dB

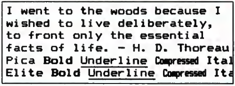


FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Pica Bold Underline Compressed Ital
Elite Bold Underline Compressed Ita

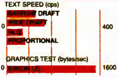
ALPS P2424C

24-pin
$1,495

Paper size

LET	LEG	11X17

Sound level
72 dB



FORMATTING

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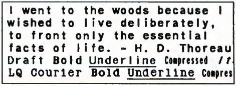
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Draft Bold Underline Compressed /I
LQ Courier Bold Underline Compres

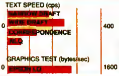
AMT Accel-500

24-pin
$1,285

Paper size

LET	LEG	11X17

Sound level
69 dB

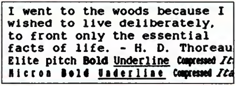


FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	
	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Elite pitch Bold Underline Compressed It
Micron Bold Underline Compressed Ita

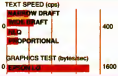
Brother M-1724L

24-pin
$949

Paper size

LET	LEG	11X17

Sound level
79 dB



FORMATTING

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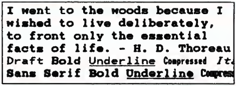
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Draft Bold Underline Compressed It
Sans Serif Bold Underline Compres

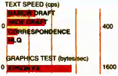
Brother M-2518

18-pin
$1,295

Paper size

LET	LEG	11X17

Sound level
76 dB



FORMATTING

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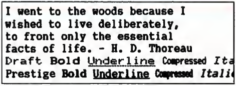
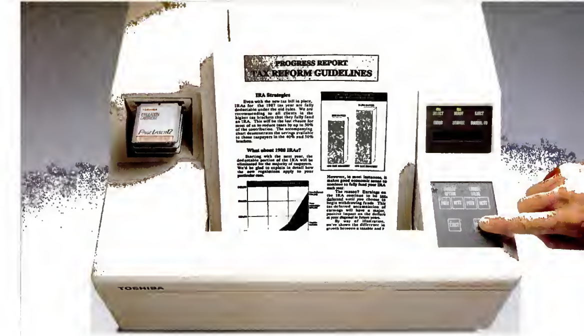
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Draft Bold Underline Compressed Ita
Prestige Bold Underline Compressed Itali



PROGRESS REPORT
TAX REFORM GUIDELINES

IRA Strategies

Even with the new tax bill in place, IRAs for the 1987 tax year are fully deductable under the old rules. We are recommending to all clients in the higher tax brackets that they fully fund an IRA. This will be the last chance for most of us to reduce taxes by up to 50% of the contribution. The accompanying chart demonstrates the savings available to those taxpayers in the 40% and 50% brackets.

What about 1988 IRAs?

Starting with the next year, the deductable portion of the IRA will be eliminated for the majority of taxpayers. We'd be glad to explain in detail how the new regulations apply to your particular case.

However, in most instances, it makes good economic sense to continue to fully fund your IRA each year.

The reason? Earnings on the IRA continue to be tax-deferred until you choose to begin withdrawing funds. This tax-deferred accumulation of earnings will have a major, positive impact on the dollars at your disposal in future years.

By way of illustration, we've shown the difference in growth between a taxable and a

If You Think Its Speed Is Impressive, Wait Until You See How It Handles.

In the world of laser printers, the PageLaser12 is an absolute speed demon.

Because at an incredible 12 pages per minute, it's 50 percent faster than most laser printers. Which means you can finish your paperwork 50 percent faster as well.

But all the speed in the world is meaningless without paper handling that's equally quick and nimble. So with our optional dual bin sheet feeder, the PageLaser12 offers three-bin versatility and a massive 750-sheet paper capacity. And our optional automatic envelope feeder lets you zip through 100 envelopes at a time without reloading.

All told, the PageLaser12 has the ability to access up to four different paper sources—whether it's letter, legal, letterhead or envelopes—without having to change paper bins by hand.

Naturally, standard equipment includes all the most popular emulations you'll need to get started, including HP LaserJet®-compatible fonts.

So whether you use the versatile PageLaser12 in a single-user high speed/high volume application or in a shared environment, you won't find a better way to get your paperwork moving faster.

To find out more about the PageLaser12, call 1-800-457-7777. That is, of course, if you're ready to break a few speed limits around the office.

LaserJet is a registered trademark of Hewlett-Packard

In Touch with Tomorrow

TOSHIBA

Toshiba America Inc., Information Systems Division

CIRCLE 322 ON READER SERVICE CARD

The PC Magazine Printer Guide: Dot Matrix Printers

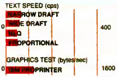
Canon BJ-130

Ink jet
$1,095

Paper size

LET	LEG	11X17

Sound level
<55 dB



FORMATTING

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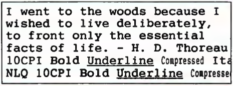
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
10CPI **Bold** Underline Compressed *Ita*
NLQ 10CPI **Bold** Underline Compresse

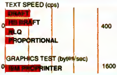
Citizen MSP-40

9-pin
$499

Paper size

LET	LEG	

Sound level
79 dB

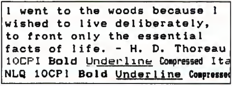


FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
10CPI **Bold** Underline Compressed *Ita*
NLQ 10CPI **Bold** Underline Compressed

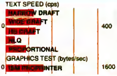
Citizen MSP-55

9-pin
$829

Paper size

LET	LEG	11X17

Sound level
76 dB

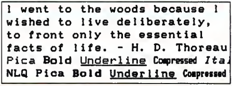


FORMATTING

	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST

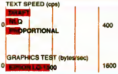

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Pica **Bold** Underline Compressed *Ital*
NLQ Pica **Bold** Underline Compressed

Citizen Tribute 124

24-pin
$749
(+ $100 card)
Paper size

LET	LEG	

Sound level
72 dB

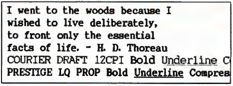


FORMATTING

Center	Justified
	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
COURIER DRAFT 12CPI **Bold** Underline C
PRESTIGE LQ PROP **Bold** Underline Compres

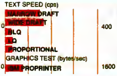
C. Itoh CI-2500

9-pin
$1,049

Paper size

LET	LEG	11X17

Sound level
80 dB

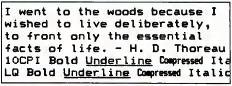


FORMATTING

Dbl Hi	Proport
DblWide	VForm
	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
10CPI **Bold** Underline Compressed *Ita*
LQ **Bold** Underline Compressed *Italic*

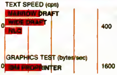
C. Itoh Triprinter CI-5000

9-pin
$1,995

Paper size

LET	LEG	11X17

Sound level
73 dB

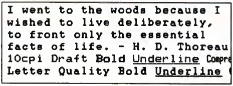


FORMATTING

Dbl Hi	
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
10cpi Draft **Bold** Underline Compre
Letter Quality **Bold** Underline

COOL, QUIET POWER

SILENCER 150

ULTRA QUIET

- PC/XT compatible
- 150 watts of power
- system runs 5°-15° cooler
- 84% noise reduction

$129

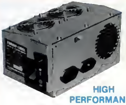
TURBO-COOL 150

PERFECT UPGRADE

- PC/XT compatible
- 155 watts of power
- system runs 25°-40° cooler
- 50% noise reduction

$149

TURBO-COOL 200

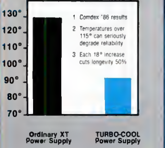


HIGH PERFORMANCE

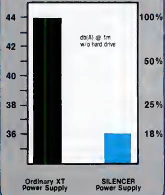
- PC/XT/Mini AT compatible
- 200 watts of power
- system runs 30°-45° cooler
- standard noise level

$189

EXPANSION CARDS TEMPERATURE TEST



NOISE LEVELS



TURBO-COOL AND SILENCER POWER SUPPLIES: POWER PACKED AND BUILT TO LAST

- full rated power
- low output ripple
- heavy duty components
- FCC-B compliance
- UL (#E114179:TC150/200)
- OV, OC, SC protection
- patented twin fan slope-cover design for max. cooling vs noise (TC150/200)
- high capacity West German cooling fan w/adjustable speed control (TC250)
- installation instructions; 4 drive plugs
- rigorously tested; 1 yr. warranty

SILENCER 200

ULTRA QUIET

- AT compatible
- 200 watts of power
- adjustable cooling (1.0X-1.3X)
- 69% noise reduction @ 1.0X

$159

TURBO-COOL 250

HIGH PERFORMANCE

- AT compatible
- 250 watts of power
- adjustable cooling (1.3X-1.8X)
- 386 boards and hard drives run up to 35° cooler

$189

ALSO AVAILABLE

Turbo-Cool PC/XT Auxiliary Cooling Unit *(system runs 15°-30° cooler)*	$59
Turbo-Cool AT Auxiliary Cooling Unit *(system runs 15°-30° cooler)*	$75
Compaq 180W Power Supply *(upgrades the original portable)*	$169
Turbo 375 AT Power Supply *(power for up to 12 cards & 8 drives, wide input range, 0.4% regulation, 50,000 hr MTBF, 2 yr. warranty)*	$325

CIRCLE 473 ON READER SERVICE CARD

PC POWER & COOLING, INC.
31510 Mountain Way, Bonsall, CA 92003
(619) 723-9513 • FAX (619) 723-0075

The PC Magazine Printer Guide: Dot Matrix Printers

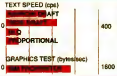
Copal Writehand 5930

18-pin
$1,195

Paper size

LET	LEG	11X17

Sound level
76 dB

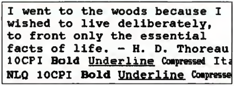


FORMATTING

Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
10CPI Bold Underline Compressed Ita
NLQ 10CPI Bold Underline Compresse

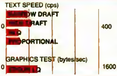
Copal Writehand 6730

24-pin
$995

Paper size

LET	LEG	11X17

Sound level
72 dB

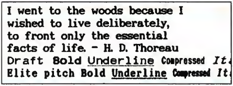


FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Draft Bold Underline Compressed It
Elite pitch Bold Underline Compressed It

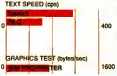
Dataproducts SI 480

Ink jet
$2,795

Paper size

LET	LEG	

Sound level
<55 dB

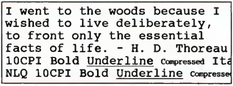


FORMATTING

	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
10CPI Bold Underline Compressed Ita
NLQ 10CPI Bold Underline Compresse

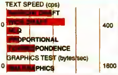
Dataproducts 8070 Plus

18-pin
$1,595

Paper size

LET	LEG	11X17

Sound level
70 dB

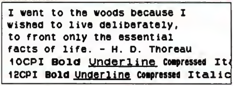


FORMATTING

	Justified
	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
10CPI Bold Underline Compressed Ita
12CPI Bold Underline Compressed Italic

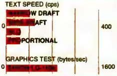
Dataproducts 9044

24 pin
$1,099

Paper size

LET	LEG	11X17

Sound level
76 dB

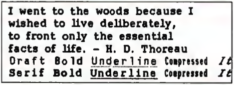


FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Draft Bold Underline Compressed It
Serif Bold Underline Compressed It

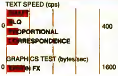
Diconix 300

Ink jet
$599

Paper size

LET	LEG	

Sound level
56 dB

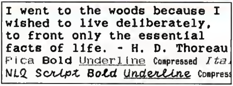


FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Pica Bold Underline Compressed Ita
NLQ Script Bold Underline Compress

XyWrite III Plus makes powerful word processing a piece of cake.

New A La Carte menus let you use the power of XyWrite III Plus right from the start. A single keystroke produces a menu of logical options. Simple choices achieve sophisticated results.

A La Carte menus are an alternative to XyWrite's command system. They let you go to work immediately while reinforcing the commands and reducing the learning curve. They also provide help for the task at hand.

Unlike other menu systems, you can choose to work with A La Carte or without it. After all, when you know exactly what you want, you don't need to consult a menu.

XYQUEST

For product & dealer information contact:
XYQUEST, Inc.
44 Manning Road, Billerica, MA 01821
(508) 671-0888

XyWrite III Plus
A La Carte
menus
The most powerful word processor is now the easiest to learn
XYQUEST

TOP

PC MAGAZINE EDITORS' CHOICE

Software Digest
#1 RATED ADVANCED WORD PROCESSOR, 1988

CIRCLE 518 ON READER SERVICE CARD

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WordPerfect
CORPORATION

CIRCLE 508 ON READER SERVICE CARD

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The PC Magazine Printer Guide: Dot Matrix Printers

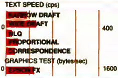
Diconix 300w

Ink jet
$749

Paper size

LET	LEG	11X17

Sound level
55 dB



FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Proportional 10CPI Bold Underline Com
12CPI Bold Underline Compressed Italic

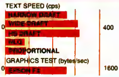
Epson DFX-5000

9-pin
$2,199

Paper size

LET	LEG	11X17

Sound level
72 dB



FORMATTING

	Justified
	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Pica Bold Underline Compressed Ita
NLQ Sans Serif Bold Underline

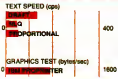
Epson FX-850

9-pin
$549

Paper size

LET	LEG	

Sound level
72 dB



FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Elite Bold Underline Compressed Italic C
NLQ Pica Bold Underline Compressed

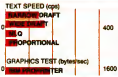
Epson FX-1050

9-pin
$799

Paper size

LET	LEG	11X17

Sound level
73 dB



FORMATTING

	Justified
Dbl Hi	Proport
DblWide	VForm
	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Elite Bold Underline Compressed Italic C
NLQ Pica Bold Underline Compressed

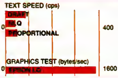
Epson LQ-500

24-pin
$495

Paper size

LET	LEG	

Sound level
72 dB



FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Draft Bold Underline Compressed It
San Serif Bold Underline Compresse

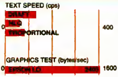
Epson LQ-950

24-pin
$949

Paper size

LET	LEG	11X17

Sound level
67 dB



FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Draft Bold Underline Compressed It
Courier Bold Underline Compressed

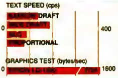
The PC Magazine Printer Guide: Dot Matrix Printers

Epson LQ-2550

24-pin
$1,499

Paper size
LET LEG 11X17

Sound level
66 dB

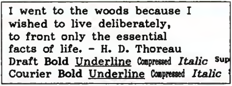


FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST

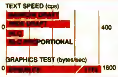

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Draft Bold Underline Compressed *Italic* Sup
Courier Bold Underline Compressed *Italic*

Fujitsu DL5600

24-pin
$2,195

Paper size
LET LEG 11X17

Sound level
76 dB



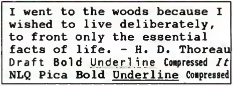
FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

IBM Proprinter

CHARACTER TEST

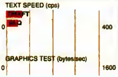

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Draft Bold Underline Compressed *It*
NLQ Pica Bold Underline Compressed

Hewlett-Packard DeskJet

Ink jet
$995

Paper size
LET LEG

Sound level
<55 dB



FORMATTING

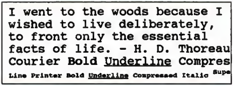
	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

HP LaserJet

Not Applicable

CHARACTER TEST

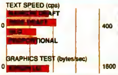

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Courier Bold Underline Compres
Line Printer Bold Underline Compressed Italic Supe

Hewlett-Packard RuggedWriter

24-pin
$1,695

Paper size
LET LEG 11X17

Sound level
74 dB

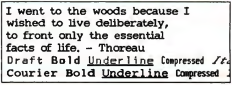


FORMATTING

	Justified
	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST

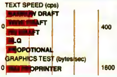

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - Thoreau
Draft Bold Underline Compressed *It*
Courier Bold Underline Compressed

IBM Proprinter II XL

9-pin
$799

Paper size
LET LEG 11X17

Sound level
74 dB



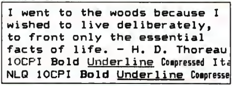
FORMATTING

Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

IBM Proprinter

CHARACTER TEST

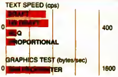

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
10CPI Bold Underline Compressed Ita
NLQ 10CPI Bold Underline Compresse

IBM Proprinter III

9-pin
$649

Paper size
LET LEG 11X17

Sound level
71 dB



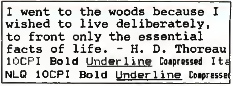
FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

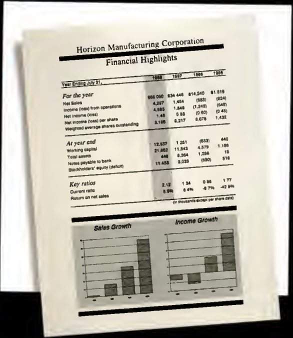
GRAPHICS TEST

IBM Proprinter

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
10CPI Bold Underline Compressed Ita
NLQ 10CPI Bold Underline Compresse

Excel or 1-2-3?



Horizon Manufacturing Corporation

Financial Highlights

Year Ending July 31,	1988	1987	1986	1985
For the year				
Net Sales	$66 090	$34 448	$14,240	$1 519
Income (loss) from operations	4,257	1,484	(583)	(624)
Net income (loss)	4,585	1,849	(1,242)	(648)
Net income (loss) per share	1.48	0.83	(0.60)	(0.45)
Weighted average shares outstanding	3,166	6,217	6,078	1,432
At year end				
Working capital	12,537	1 251	(633)	440
Total assets	21,862	11,843	4,579	1,186
Notes payable to bank	446	6,364	1,286	15
Stockholders' equity (deficit)	11,453	3,033	(590)	516
Key ratios				
Current ratio	2.12	1.34	0.96	1.77
Return on net sales	6.9%	5.4%	-8.7%	-42.8%

(in thousands except per share data)

Sales Growth

Income Growth

This printout was created on an HP LaserJet® using—
was it Microsoft® Excel, or was it Lotus 1-2-3®?

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Introducin

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And for the bottom line, double-underline.

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And whether you have a dot-matrix or a laser printer, Allways will take your printer to the limit. You'll be able to use your printer's internal fonts as well as the fonts that Allways supplies, for an incredible variety of formatting options.

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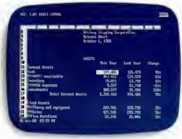
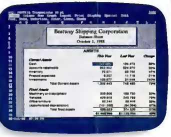
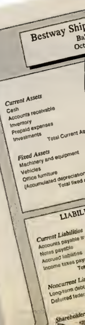


1 *Create your worksheet in 1-2-3 as always*



2 *Pop into Allways to make it look great*



3 *What you see in Allways is what you get on paper*

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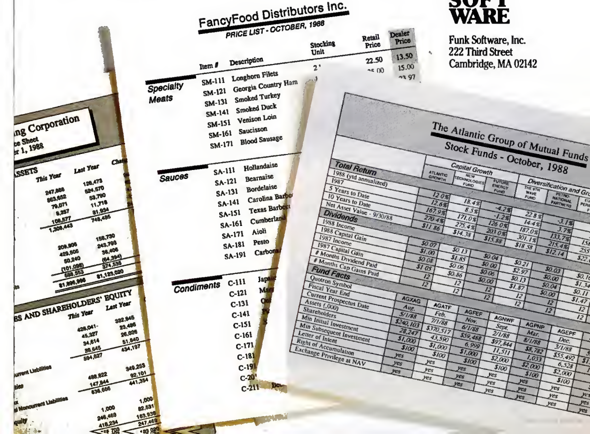
Cambridge, MA 02142



FancyFood Distributors Inc.
PRICE LIST - OCTOBER, 1988

	Item #	Description	Stocking Unit	Retail Price	Dealer Price
Specialty Meats	SM-111	Longhorn Filets		22.50	13.50
	SM-121	Georgia Country Ham			15.00
	SM-131	Smoked Turkey			
	SM-141	Smoked Duck			
	SM-151	Venison Loin			
	SM-161	Saucisson			
	SM-171	Blood Sausage			
Sauces	SA-111	Hollandaise			
	SA-121	Bearnaise			
	SA-131	Bordelaise			
	SA-141	Carolina Barb			
	SA-151	Texas Barb			
	SA-161	Cumberland			
	SA-171	Aioli			
	SA-181	Pesto			
	SA-191	Carbon			
Condiments	C-111	Japa			
	C-121	Ma			
	C-131				
	C-141				
	C-151				
	C-161				
	C-171				
	C-181				
	C-191				
	C-211	Be			

ng Corporation
ce Sheet
r 1, 1988

SSETS — This Year — Last Year

S AND SHAREHOLDERS' EQUITY — This Year — Last Year

The Atlantic Group of Mutual Funds
Stock Funds - October, 1988

	Capital Growth			Diversification and Gr		
	ATLANTIC GROWTH	NEW TECHNOLOGIES FUND	FUTURE ENERGY FUND	THE 9TH WAVE FUND	PETRO-NATIONAL PARTNERS	
Total Return						
1988 (ytd annualized)	12.0%	18.4%	-4.2%	22.8%	-3.1%	
1987	12.6%	8.5%	-1.2%	14.4%	3.7%	
5 Years to Date	167.9%	171.0%	126.0%	187.0%	133.7%	158
10 Years to Date	270.4%	275.4%	203.0%	301.1%	215.4%	255
Net Asset Value - 9/30/88	$11.86	$14.38	$15.88	$18.58	$12.14	$22.
Dividends						
1988 Income	$0.07	$0.13	$0.04	$0.21	$0.03	$0.1
1988 Capital Gain	$1.00	$1.85	$0.00	$2.97	$0.00	$1.34
1987 Income	$0.08	$0.06	$0.06	$0.13	$0.04	$0.11
1987 Capital Gain	$1.05	$0.86	$0.00	$1.87	$0.00	$1.47
# Months Dividend Paid	12	12	12	12	12	12
# Months Cap Gains Paid	12	12	12	12	12	12
Fund Facts						
Quotron Symbol	AGXAG	AGATF	AGFEF	AGNWF	AGPNP	AGEPF
Fiscal Year End	Aug.	Feb.	Nov.	Sept.	Mar.	Dec.
Current Prospectus Date	5/1/88	7/1/88	6/1/88	2/1/88	8/1/88	3/1/88
Assets (,000)	$240,103	$370,517	$59,488	$97,844	$8,782	$55,492
Shareholders	28,247	43,590	6,999	11,511	1,033	6,528
Min Initial Investment	$1,000	$1,000	$1,000	$2,000	$2,000	$2,000
Min Subsequent Investment	$100	$100	$100	$100	$100	$100
Letter of Intent	yes	yes	yes	yes	yes	yes
Right of Accumulation	yes	yes	yes	yes	yes	yes
Exchange Privilege at NAV	yes	yes	yes	yes	yes	yes

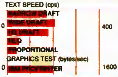
The PC Magazine Printer Guide: Dot Matrix Printers

IBM Proprinter III XL

9-pin
$899

Paper size
LET | LEG | 11X17

Sound level
70 dB



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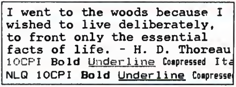
GRAPHICS TEST

IBM Proprinter

CHARACTER TEST

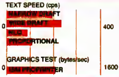

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
10CPI Bold Underline Compressed Ita
NLQ 10CPI Bold Underline Compresse

IBM Quickwriter

24-pin
$1,699

Paper size
LET | LEG | 11X17

Sound level
76 dB



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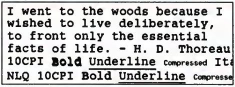
GRAPHICS TEST

IBM Proprinter

CHARACTER TEST


I went to the woods because I
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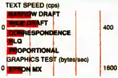
facts of life. - H. D. Thoreau
10CPI Bold Underline Compressed Ita
NLQ 10CPI Bold Underline Compresse

Infoscribe Model 1100

9-pin
$1,590

Paper size
LET | LEG | 11X17

Sound level
72 dB



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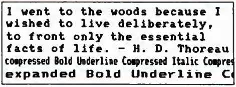
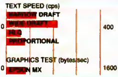

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
compressed Bold Underline Compressed Italic Compres
expanded Bold Underline C

Infoscribe Model 1400

18-pin
$1,845

Paper size
LET | LEG

Sound level
68 dB



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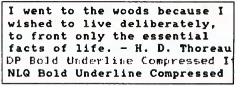
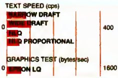

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
DP Bold Underline Compressed I
NLQ Bold Underline Compressed

Mannesmann Tally 222

24-pin
$899

Paper size
LET | LEG | 11X17

Sound level
79 dB



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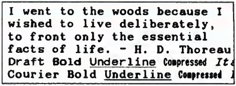
GRAPHICS TEST

CHARACTER TEST

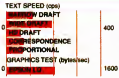

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Draft Bold Underline Compressed Ita
Courier Bold Underline Compressed

Mannesmann Tally 230/24

24-pin
$1,499

Paper size
LET | LEG | 11X17

Sound level
78 dB



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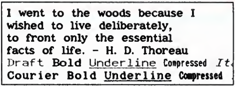
I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Draft Bold Underline Compressed It
Courier Bold Underline Compressed

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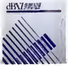

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CIRCLE 529 ON READER SERVICE CARD

Good News For
People Who've Always Wanted A
TARGA 16...

The PC Magazine Printer Guide: Dot Matrix Printers

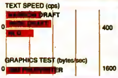
Mannesmann Tally 340

18-pin
$2,278

Paper size

LET	LEG	▨

Sound level
72 dB



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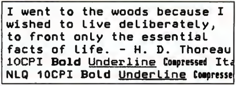


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
10CPI **Bold** Underline Compressed Ita
NLQ 10CPI **Bold** Underline Compresse

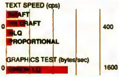
NEC Pinwriter 2200

24-pin
$569

Paper size

LET	LEG	▨

Sound level
74 dB



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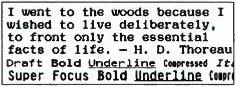


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. – H. D. Thoreau
Draft **Bold** Underline Compressed It
Super Focus **Bold** Underline Compr

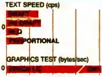
NEC Pinwriter 5200

24-pin
$799

Paper size

LET	LEG	▨

Sound level
71 dB



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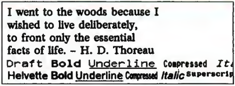


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Draft **Bold** Underline Compressed It
Helvette **Bold** Underline Compressed *Italic* Superscrip

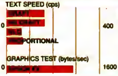
Okidata Microline 320

9-pin
$499

Paper size

LET	LEG	▨

Sound level
74 dB



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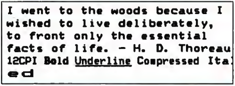


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
12CPI **Bold** Underline Compressed Ita
ed

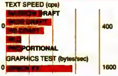
Okidata Microline 321

9-pin
$699

Paper size

LET	LEG	▨

Sound level
72 dB



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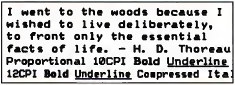


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Proportional 10CPI **Bold** Underline
12CPI **Bold** Underline Compressed Ita

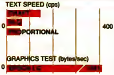
Okidata Microline 390

24-pin
$699

Paper size

LET	LEG	11X17

Sound level
74 dB



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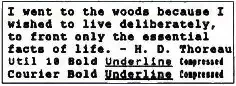


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Util 10 **Bold** Underline Compressed
Courier **Bold** Underline Compressed

The PC Magazine Printer Guide: Dot Matrix Printers

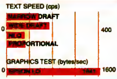
Okidata Microline 391

24-pin
$949

Paper size

LET	LEG	11X17

Sound level
72 dB



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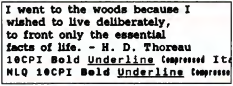
GRAPHICS TEST

CHARACTER TEST



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I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
10CPI Bold Underline Compressed It
NLQ 10CPI Bold Underline Compresse
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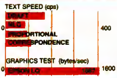
Okidata Microline 393C

24-pin
$1,499

Paper size

LET	LEG	

Sound level
79 dB



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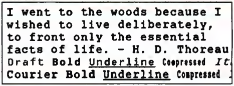
GRAPHICS TEST

CHARACTER TEST



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I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Draft Bold Underline Compressed It
Courier Bold Underline Compressed
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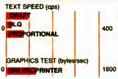
Relisys RP1814

9-pin
$225

Paper size

LET	LEG	

Sound level
76 dB



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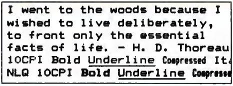

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I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
10CPI Bold Underline Compressed It
NLQ 10CPI Bold Underline Compresse
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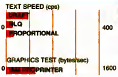
Relisys RP2410

9-pin
$749

Paper size

LET	LEG	

Sound level
70 dB



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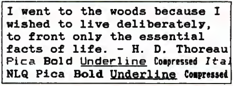

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I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Pica Bold Underline Compressed Ital
NLQ Pica Bold Underline Compressed
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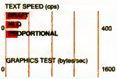
Relisys VP1821

24-pin
$599

Paper size

LET	LEG	11X17

Sound level
72 dB



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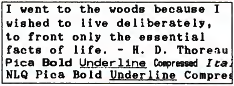
GRAPHICS TEST

Not Applicable

CHARACTER TEST



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I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Pica Bold Underline Compressed Ita
NLQ Pica Bold Underline Compres
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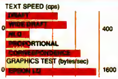
Seikosha SBP-10AI

18-pin
$4,495

Paper size

LET	LEG	11X17

Sound level
75 dB



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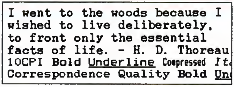
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST



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I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
10CPI Bold Underline Compressed It
Correspondence Quality Bold Un
```

we never stop asking

"What if..."

How to look good from start...

PACIFIC

COMPETITIVE MARKET PROFILE

YEARLY TRENDS

RXC Brake System

PACIFIC

Mail Order Price Sheet

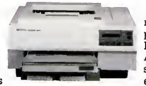
PATH

CYCLIST JAN BELL BRINGS HOME THE GOLD

BRAKE SYSTEM PULLS OUT ALL STOPS AT BPP CLASSIC

PACIFIC

to finish.



The HP LaserJet Series II Printer.

Nothing brings your ideas to life like the HP LaserJet Series II Printer—from office memos to forms to newsletters. As the leading laser printer, it works with all popular PCs and PC software packages. And, with a wide range of fonts, you get more options to create superior looking documents.

With additional memory you can even print sophisticated 300 DPI full-page graphics. And with HP's ScanJet scanner, you can also easily add photographs, illustrations and text.

No wonder more people choose the original over all other laser printers combined.

So call 1 800 752-0900, Ext. 900D for your nearest HP dealer.

HEWLETT PACKARD

Print samples were created using Microsoft Word, Microsoft Excel, and Aldus PageMaker.

CIRCLE 342 ON READER SERVICE CARD

The PC Magazine Printer Guide: Dot Matrix Printers

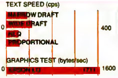
Seikosha SL-130AI

24-pin
$999

Paper size

LET	LEG	11X17

Sound level
71 dB

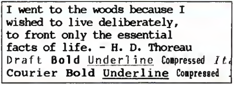


FORMATTING

▨	▨
▨	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST



I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Draft Bold Underline Compressed It
Courier Bold Underline Compressed

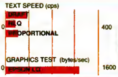
Star Micronics NB 24-10

24-pin
$749

Paper size

LET	LEG	▨

Sound level
73 dB

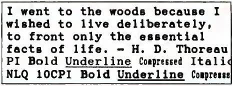


FORMATTING

Center	▨
▨	▨
▨	VForm
▨	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST



I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. – H. D. Thoreau
PI Bold Underline Compressed Itali
NLQ 10CPI Bold Underline Compress

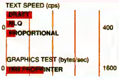
Star Micronics NR-10

9-pin
$529

Paper size

LET	LEG	▨

Sound level
73 dB



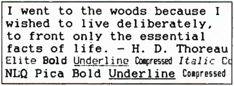
FORMATTING

Center	▨
▨	▨
▨	VForm
▨	VLine
HorzTab	VTab

GRAPHICS TEST

IBM Proprinter

CHARACTER TEST



I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. – H. D. Thoreau
Elite Bold Underline Compressed Italic C
NLQ Pica Bold Underline Compressed

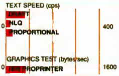
Star Micronics NX-1000

9-pin
$299

Paper size

LET	LEG	▨

Sound level
72 dB



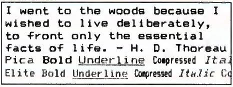
FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

IBM Proprinter

CHARACTER TEST



I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. – H. D. Thoreau
Pica Bold Underline Compressed Ital
Elite Bold Underline Compressed Italic C

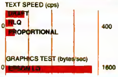
Star Micronics NX-2400

24-pin
$529

Paper size

LET	LEG	▨

Sound level
77 dB

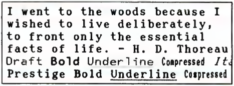


FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST



I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. – H. D. Thoreau
Draft Bold Underline Compressed It
Prestige Bold Underline Compressed

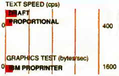
Tandy DMP 106

7-pin
$255 (inc. cable)

Paper size

LET	LEG	▨

Sound level
80 dB



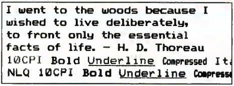
FORMATTING

▨	▨
▨	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

IBM Graphics

CHARACTER TEST

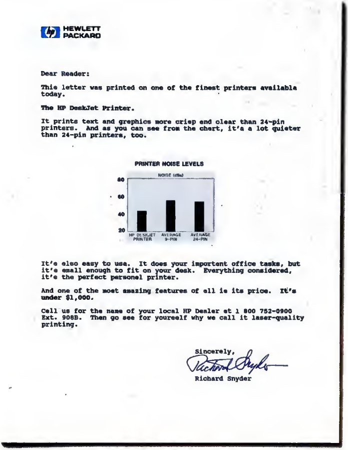


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. – H. D. Thoreau
10CPI Bold Underline Compressed It
NLQ 10CPI Bold Underline Compress

we never stop asking

What if.

Small cash input for laser-quality output.



HEWLETT PACKARD

Dear Reader:

This letter was printed on one of the finest printers available today.

The HP DeskJet Printer.

It prints text and graphics more crisp and clear than 24-pin printers. And as you can see from the chart, it's a lot quieter than 24-pin printers, too.

PRINTER NOISE LEVELS

NOISE (dBa)
80
60
40
20
HP DESKJET PRINTER
AVERAGE 9-PIN
AVERAGE 24-PIN

It's also easy to use. It does your important office tasks, but it's small enough to fit on your desk. Everything considered, it's the perfect personal printer.

And one of the most amazing features of all is its price. It's under $1,000.

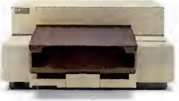
Call us for the name of your local HP Dealer at 1 800 752-0900 Ext. 908B. Then go see for yourself why we call it laser-quality printing.

Sincerely,

Richard Snyder

Richard Snyder

The HP DeskJet Printer. Laser-Quality Output for Under $1000.



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CIRCLE 239 ON READER SERVICE CARD

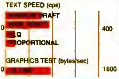
The PC Magazine Printer Guide: Dot Matrix Printers

Tandy DMP 440

9-pin
$699

Paper size
LET | LEG | 11X17

Sound level
77 dB



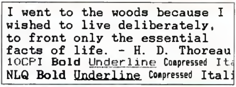
FORMATTING

	Proport
DblWide	
Compr	
HorzTab	VTab

GRAPHICS TEST

IBM Proprinter

CHARACTER TEST

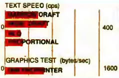

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
10CPI Bold Underline Compressed Ita
NLQ Bold Underline Compressed Itali

Tandy DMP 2120

24-pin
$1,599

Paper size
LET | LEG | 11X17

Sound level
78 dB



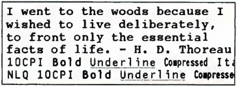
FORMATTING

Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

IBM Proprinter

CHARACTER TEST

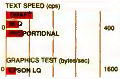

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
10CPI Bold Underline Compressed Ita
NLQ 10CPI Bold Underline Compresse

Texas Instruments Omni 800 Model 875

24-pin
$799

Paper size
LET | LEG

Sound level
77 dB

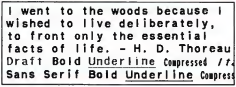


FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST

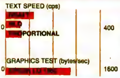

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Draft Bold Underline Compressed *It*
Sans Serif Bold Underline Compress

Texas Instruments Omni 800 Model 877

24-pin
$999

Paper size
LET | LEG | 11X17

Sound level
78 dB

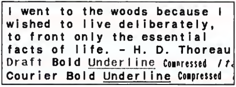


FORMATTING

Center	Justified
Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

CHARACTER TEST

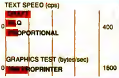

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
Draft Bold Underline Compressed *It*
Courier Bold Underline Compressed

Toshiba P321SLC

24-pin
$949

Paper size
LET | LEG

Sound level
69 dB



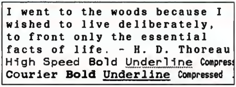
FORMATTING

Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

IBM Proprinter

CHARACTER TEST

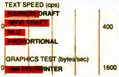

I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
High Speed Bold Underline Compres
Courier Bold Underline Compressed

Toshiba P351SX

24-pin
$1,599

Paper size
LET | LEG | 11X17

Sound level
69 dB



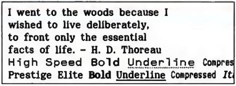
FORMATTING

Dbl Hi	Proport
DblWide	VForm
Compr	VLine
HorzTab	VTab

GRAPHICS TEST

IBM Proprinter

CHARACTER TEST


I went to the woods because I
wished to live deliberately,
to front only the essential
facts of life. - H. D. Thoreau
High Speed Bold Underline Compres
Prestige Elite Bold Underline Compressed *It*

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CIRCLE 303 ON READER SERVICE CARD

PC BRAND 286/12 $995

12 MHz Clock, Zero Wait Operation,
Norton SI 15.3 •Landmark™ Speed 16MHz
512K, 1.2MB or 1.44MB Drive, 101- Keyboard

Standard System Features:

- 80286 Processor Operating at 12MHz with Zero Wait States delivering 16MHz Effective Throughput
- 512K RAM expandable to 4MB on the System board using 256K and/or 1MB 100ns RAM chips
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- High Performance Dual Hard Drive/Floppy Drive Controller
- Enhanced 101-key AT Style Keyboard
- High Capacity System Power supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 Co-Processor Support
- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, NOVELL, 3COM and PCNET compatibility
- Built-in System Board LIM EMS hardware drivers
- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (6 16Bit & 2 8Bit)
- Small foot print case with 4 Disk Drive bays

Options:

- Full size 5 drive case • Factory Installed RAM Upgrades
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD Portable • Tower Case

Standard Pre-Built Configurations:

286/12 With 512K, Hard Disk Drive, Monitor & Video Card

Video \ Drives	20MB	40MB-40MS	40MB-28MS	80MB-28MS
Mono	$1381	$1485	$1594	$1725
EGA	$1775	$1879	$1988	$2119
VGA	$1946	$2050	$2159	$2290

PC BRAND 286/20 $1400

20 MHz Clock, Zero Wait Operation
Norton SI 20.4 •Landmark™ Speed 25.9MHz
512K, 1.2MB or 1.44MB Drive, 101-Keyboard

Standard System Features:

- 80286 Processor Operating at 20MHz with Zero Wait States in interleave mode delivering 26MHz Effective Throughput
- 512K RAM expandable to 8MB on the System board using 256K and/or 1MB 100ns RAM chips (4MB on motherboard and 4MB on optional special interleaving daughter card)
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- High Performance Dual Hard Drive/Floppy Drive controller
- Enhanced 101-key AT Style Keyboard
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 Co-Processor Support
- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, NOVELL, 3COM, and PCNET compatibility
- Built-in System Board LIM 4.0 EMS hardware drivers
- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (6 16Bit & 2 8Bit)
- Medium foot print case with 5 Disk Drive bays

Options:

- Tower Case • 4MB Interleaving Ram Card
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD Portable • Factory Installed RAM Upgrades

Standard Pre-Built Configurations:

286/20 With 512K, Hard Disk Drive, Monitor & Video Card

Drives \ Video	40MB-40MS	40MB-28MS	80MB-28MS	110MB-28MS 1:1 RLL	150-17MS 1:1 ESDI	320-16MS 1:1 ESDI
Mono	$1890	$1999	$2130	$2396	$3623	$4023
EGA	$2284	$2393	$2524	$2790	$4017	$4417
VGA	$2455	$2564	$2695	$2961	$4188	$4588

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PCV20 AD-II $695

15 MHz Throughput in an XT. Complete with Monographics Card & Monitor.

512K, 360K Drive, Mono Card & Monitor, 84-Keyboard

Standard System Features:

- Nec V20 CPU providing 1.5 times the power of the 8088!
- 512K RAM standard. Expadable to 1MB
- One 360K Floppy Drive • 84-key AT Style Keyboard
- 4-layer Motherboard Expandable to 1MB
- 8 Slots. Serial, Parallel, Game Ports, and Clock Standard
- Hercules Compatible Graphics Card
- 12" Monochrome Monitor
- Accomodates up to 4 HH Mass Storage devices
- AT Style Case with Keylock, Turbo, Power and Hard Drive LEDs.
- Photo-illustrated Set-up & Operating instructions.

Standard Pre-Built Configurations:

PCV20 AD-II With 512K, Hard Disk Drive, Monitor & Video Card					
Video \ Drive	1 Floppy	2 Floppy	20MB	30MB	40MB
Mono	$695	$770	$964	$990	$1107
RGB	$879	$954	$1148	$1174	$1291
EGA	$1089	$1164	$1358	$1384	$1501

PC BRAND 386/20 $2100

20 MHz Clock, Zero Wait Operation
Norton SI 24 • Landmark Speed 30MHz

1024K, 1.2MB or 1.44MB Drive, 101-Keyboard

Standard System Features:

- Intel 80386 Processor Operating at 20MHz with Zero Wait States in interleave mode delivering 30MHz Effective Throughput
- 1024K RAM standard expandable to 16MB via 32Bit RAM boards using 256K and/or 1MB 80ns RAM chips
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- High Performance Dual Hard Drive/Floppy Drive controller
- Enhanced 101-key AT Style Keyboard
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 or 80387 Co-Processor Support
- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, NOVELL, 3COM and PCNET compatibility
- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (6 16Bit & 2 8Bit & 2 32Bit)
- Medium foot print case with 5 Disk Drive bays

Options:

- Tower Case • Factory Installed RAM Upgrades
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD Portable • 8MB 32Bit RAM Card Upgrade

Standard Pre-Built Configuration:

386/20 With 1024K, Hard Disk Drive, Monitor & Video Card						
Video \ Drives	40MB-40MS	40MB-28MS	80MB-28MS	110-28MS 1:1RLL	150-17MS 1:1ESDI	320-16MS 1:1ESDI
Mono	$2590	$2699	$2830	$3096	$4323	$4723
EGA	$2984	$3093	$3224	$3490	$4717	$5117
VGA	$3155	$3264	$3395	$3661	$4888	$5288

TOWER CASE $220

Add $220 to any Desktop Configuration

Modeled in IBM's PS/2-80 Style, this unit offers:

- 220 Watt Power Supply
- Two 3.5" Front Accessible Drive Bays
- Two 5.25" Front Accessible Drive Bays
- One 5.25" FULL SIZE Internal Drive Bay
- TURBO MHz Digital Speed Display
- Easy Access Snap-off Side Panel for quick "no-screwdriver" access to internals

CIRCLE 309 ON READER SERVICE CARD

PC BRAND 386/25 $2450

The Fastest Personal Workstation and File Server on the Market!

25 MHz Clock, Zero Wait Operation
Norton SI 28.3 • Landmark Speed 35MHz
1024K, 1.2MB or 1.44MB Drive, 101-Keyboard

Standard System Features:

- Intel 80386 Processor Operating at 25MHz with Zero Wait States in interleave mode delivering 35MHz Effective Throughput
- 1024K RAM standard expandable to 16MB via 32Bit RAM boards using 256K and/or 1MB RAM chips
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- High Performance Dual Hard Drive/Floppy Drive controller
- Enhanced 101-key AT Style Keyboard
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 or 80387 Co-Processor Support
- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, NOVELL, 3COM and PCNET compatibility
- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (6 16Bit & 2 8Bit & 2 32Bit)
- Medium foot print case with 5 Disk Drive bays

Options:

- Tower Case • Factory Installed RAM Upgrades
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Styie LCD Portable • 8MB 32Bit RAM Card

Standard Pre-Built Configurations:

386/25 With Hard Disk Drive, Monitor & Video Card						
Drives / Video	40MB-40MS	40MB-28MS	80MB-28MS	110MB-28MS 1:1RLL	150-17MS 1.1ESDI	320-16MS 1:1ESDI
Mono	$2940	$3049	$3180	$3446	$4673	$5073
EGA	$3334	$3443	$3574	$3840	$5067	$5467
VGA	$3505	$3614	$3745	$4011	$5238	$5638

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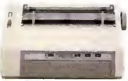

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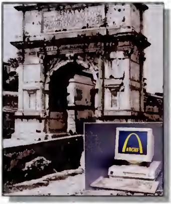
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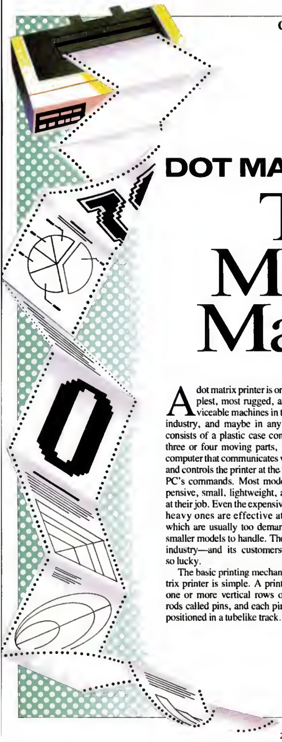


DOT MATRIX PRINTERS

The Market Matures

A dot matrix printer is one of the simplest, most rugged, and most serviceable machines in the computer industry, and maybe in any industry. It consists of a plastic case containing only three or four moving parts, plus a small computer that communicates with your PC and controls the printer at the behest of the PC's commands. Most models are inexpensive, small, lightweight, and effective at their job. Even the expensive, large, and heavy ones are effective at their jobs, which are usually too demanding for the smaller models to handle. The automobile industry—and its customers—should be so lucky.

The basic printing mechanism of a matrix printer is simple. A printhead houses one or more vertical rows of tiny metal rods called pins, and each pin is carefully positioned in a tubelike track. The pins are

With price tags ranging from $200 to $4,500, speeds that span the gamut from a crawl to a sprint, and more font flexibility than we've ever seen before, there's a dot matrix printer for every need.

spring-loaded and held back from the target ribbon and paper by electromagnets. When the charge is removed from a pin's electromagnet, the pin is released and the spring forces it into the ribbon, coloring a spot on the paper held against the printer's platen beneath the ribbon.

Pins are arranged in a single vertical row in 9-pin printheads; 24-pin models typically have three vertical rows of 8 pins each, usually arranged in a staggered pattern. The basic pin action remains the same regardless of the number of pins in the printhead.

The printhead is mounted on a track so it can slide back and forth across the target paper surface. A character is formed on the paper by coloring an appropriate pattern of spots with a so-called *character box* of horizontal and vertical spot positions in a rectangular, or matrix, pattern. The number of positions in the character box depends on the resolution of the printer. A graphic is formed by a free-form placement of spots on the paper.

As the printhead slides on its track along the paper, each pin required to form a vertical "slice" of the character or graphic is "fired" by releasing the electromagnet that holds it back from the ribbon. The computer inside the printer controls which pins are released, as well as where they are released during the printhead's trip across the track. Typically, character patterns are contained in ROM (read only memory) on the printer's system board, and they are read into memory and acted upon as the PC calls for each character. When a graphic is printed, the firing of the pins is controlled directly by the PC. In any event, enough colored spots in the right places form the character or graphic of a dot matrix printer.

THE QUEST FOR LETTER QUALITY Like display-screen engineers, printer engineers are constantly trying to squeeze more quality out of their display mechanism. All digital displays have inherently poorer quality than any continuous mechanism, such as a type ball or wheel with its fully formed characters. One approach to the quality issue is to design printers with higher dot resolution, or more dots per inch. That requires more pins in the printhead, but owing to their small diameter, 24 pins seems to be the maximum allowed by the metals available for making pins.

Another approach is to improve the character and graphics designs to use the available spots more effectively. Better use of the spots usually results in greater printer resolution without increasing the number of pins in the printhead. But a serious degradation in printer performance occurs because the printhead has to make extra trips across the same line to produce the high-resolution output.

At one time, 9-pin dot matrix printers were just not capable of letter quality printing. Early attempts at improving print quality gave them the ability to emphasize characters by printing extra dots vertically, horizontally, or both at once. That technique gave some semblance of dark printing, but the results could hardly be called quality printing.

Color, which used to require special printers, is now just another feature needing a special ribbon on a lot of inexpensive dot matrix printers.

The first efforts to create serifed fonts for the 9-pinners were noble but usually had laughable results. Better results were produced by very expensive, high-performance models such as Okidata's legendary Pacemark 2410, the Sherman tank of dot matrix printing. But most company officers and managers wouldn't accept such output as letter quality printing.

That's all changed—in a big way. Virtually all 9-pin matrix printers, many of which cost well below $500, offer "near-letter-quality" fonts. Many of them are suitable for company correspondence, and home users should be more than satisfied with the results.

Print quality has never been much of a problem for 24-pin and 18-pin printers. From the start these machines were designed to go up against daisy wheel printers and take over the letter quality market, and they have succeeded quite well. Even so, manufacturers are constantly improving the breed's output and adding more compatibility modes, font cartridges, and ribbon options to make these printers more useful. And, better yet, the prices have been coming down.

SUCCESSFUL EVOLUTION Other important printer features have been rethought and enhanced as well. Paper handling, once the bane of every printer user, has been redesigned to permit a peaceful coexistence among users, computers, and printers. The newer designs let you load paper without ripping bunches of it into shreds, tearing much of your hair out, or needing a quick trip out of the office for a manicure repair. Changing forms is almost a pleasure.

That's because many of the new printers offer you the choice of loading paper from the front, back, or bottom. Some have an output tray that holds the printed paper away from paper still being fed in, which avoids the sort of ferocious paper jams that can occur with older systems. Others come with built-in stands that give you a place beneath the printer for input and output paper. And some printers load paper automatically. All you have to do is stick the end of your tractor-fed stack into a slot and press a button; the printer takes care of the rest.

The perforated continuous-form paper so common with matrix printers is also the scourge of output quality. Even the highest-quality version of this ugly breed of paper will show telltale signs of its origins after you tear at the perforations to turn a continuously printed document into single sheets.

To avoid that problem, you can attach sheet-feeders to many of the new breed of matrix printers and stick a heap of company letterhead into the input bin. Some printer sheet-feeders have multiple bins so that distinctive second sheets and even envelopes can be fed right in.

Envelopes are another plague of printer users. Their extra thickness and gummed

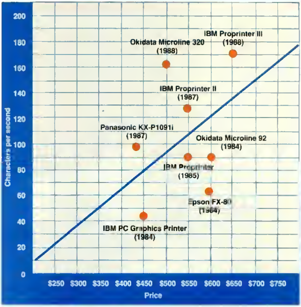
Dot Matrix Printers: Bang for the Buck

"If you want a printer with more speed, you'd better be ready to pay more to get it." That's the classic printer trade-off, and in many cases it holds true. The exceptions to the rule are the printers that are most likely to catch your eye.

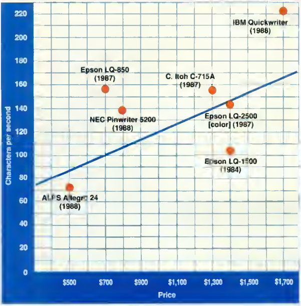
When we plot each dot matrix printer's original price against its tested speed in characters per second, patterns emerge. The machines that typify the price/speed trade-off cluster around the blue line; those that fall above that line have a better price/performance ratio, and those below it, a poorer one.

Because 9-pin and 24-pin printers compete in different markets, two graphs have been constructed, one for each category. Within each graph this year's Editor's Choices are plotted, along with selected Editor's Choices from previous years and other historically significant printers.

9-PIN DOT MATRIX PRINTERS



24-PIN DOT MATRIX PRINTERS



DOT MATRIX GRID EXPLANATION

Each dot matrix printer review begins with an emulation chart similar to those in the laser printer section. Within each chart is one grid to represent the printer's native mode and another to represent the printer's highest-quality emulation. If only one emulation is available with the printer, its characteristics are displayed in the native-mode grid.

Across the top of each grid are four of the most commonly used type enhancements: bold, italic, super/subscript, and underline. Down the left side of the grid, the most commonly used styles are listed: 10 pitch, 12 pitch, compressed, and proportional.

Note that pitches and point sizes are not interchangeable terms. Pitch is a measure of character width in a typewriter-style (monospace) font. For instance, *10 pitch* means 10 characters per horizontal inch. A point is a vertical measure (roughly 1/72 of an inch); this comes into play in typesetting and in desktop publishing with laser printers.

To determine whether a particular enhancement is available in a given style or size, find their intersection within the grid. A blackened space indicates a positive answer.—**Stephanie Izarek**

flaps have posed problems for everyone addressing letters since the typewriter was invented. PC printers seem to have only made matters worse. Many new matrix printers have some type of envelope handling, typically requiring careful insertion by hand. No new design has bested the convenience that IBM's nifty Proprinter provides, although that design comes at the cost of extra printer noise.

Dot matrix printers are also quieter than before. The head and traveler mechanisms that move them are designed to run more smoothly, and they are constructed of better materials and assembled with greater emphasis on quality to enforce that design. Most printers that can't be made quiet by mechanical means are adequately soundproofed. Other advances in printer ergonomics include covers that are easy to lift off and that stay put when you replace them, custom-built stands for large- and small-model printers, and a continuing trend toward easier-to-use operating panels and switches.

And color, which used to require special printers, is now just another feature needing only a special ribbon on a lot of relatively inexpensive printers. Mylar ribbon is also becoming commonplace; it enhances the output quality of matrix printers, especially the high-grade 24-pin models.

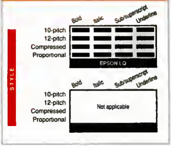
Overall, performance just keeps getting better in the matrix printer business. Our "bang for the buck" chart tells you the story of speed versus price, and that's an important part of the performance mix. If there were some easy way to measure output quality, paper-handling convenience, and noise, you can be sure we'd also publish a "balm for the buck" chart for matrix printers, and its upward curve would be even steeper than the first chart.

Overall, performance just keeps getting better in the matrix printer business.

THE YEAR IN MATRIX Some things get better, others stay the same; and it seems as if the Panasonic KX-P1091i, one of last year's Editor's Choices, remains king of the low-cost 9-pin matrix printer hill. It's hard to beat something that good, but there are some serious contenders, including new models from other old pros like NEC, Brother, Epson, and IBM.

Within the crowd of dot matrix printers in the evaluations that follow, you'll find more than 30 strong candidates to choose from. Our own Editor's Choices are at the back of this section, but read about all of them. At least one dot matrix printer reviewed here was made just for you.
—John Dickinson

ALPS Allegro 24



Allegro? Lively and brisk? Well, all right—the ALPS Allegro 24, a 24-pin dot matrix machine that ALPS America sells for $499, looks lively. And with its flatbed balanced gracefully on spindly but sturdy legs, the Allegro 24 has a distinctive design that lets it handle paper briskly.

Yes, this performer has a perky look, but its pace is perhaps more allegretto than allegro. Nevertheless, its print quality, befitting a near-$500 printer, is elegant enough to merit the kind of good notices all ambitious performers strive to attain.

Admittedly, the Allegro 24 is a showstopper. It drew the attention of everyone who passed by when we were testing the machine. The unusual, clever design (along lines similar to that of the C. Itoh ProWriter jr. Plus reviewed last year) lets you feed paper from the front of the machine without a hitch.

The printer is a sleek, flat platform, lifted by two supports. You can stack the paper under the printer, and the design stops the paper from curling and snagging.

Instead of striking horizontally against a typewriter-style platen, the 24-pin printhead of the Allegro 24 faces down and strikes against the printer's flatbed. The ribbon cartridge is positioned vertically instead of horizontally.

The paper moves smoothly up from under the front of the machine, through the

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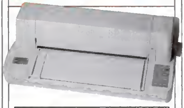


ALPS Allegro 24
ALPS America
3553 N. First St.
San Jose, CA 95134
(408) 432-6000
List Price: $499
Dimensions (HWD): 8 x 18.5 x 17.05 in.
Weight: 12.8 lbs.
Emulations: Epson LQ-2500
In Short: With its clever design for paper handling and its three resident letter-quality fonts, this 24-pin dot matrix printer is a showstopper. Unfortunately, its print speeds (71.9 cps in draft and 38.8 to 43.7 cps in letter quality) do not keep pace with its other forward-looking attributes.
CIRCLE 699 ON READER SERVICE CARD

flatbed, and onto the flat paper tray in the back. Paper loads more smoothly than with just about any other dot matrix on the market. The paper-parking feature allows easy use of both fanfold and single-sheet paper, and you can feed in single sheets without removing the fanfold forms.

ALPS America deserves an enthusiastic *bravo* for the design of the Allegro 24. But one suggestion for improving it: ALPS should make transparent at least part of the opaque triangular dome encasing the printhead and the ribbon. You should be able to see what's going on before the paper ejects.

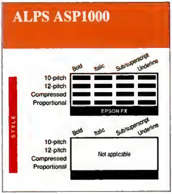
The front panel is among the better ones we've seen. Located on the right side of the Allegro 24, with small but clearly marked and well-laid-out indicator lights, it tells you all the essentials.

You can choose among resident fonts and some pitch settings (10, 12, and 17 characters per inch, as well as proportional spacing) by selecting the appropriate button. A capsule guide to the front panel is always handy; you simply flip up the printer's front cover, and it's right there.

You can also control most of the settings by using software commands or the memory mode, which selects operating defaults. Changing the memory mode settings is easy but tedious if you need to change at least one setting often; inevitably, the setting you need is somewhere between the middle and the end of the list, and you must cycle through most of the settings to get to it.

On the right side of the Allegro 24 is a slot for either a memory card or a font card. The printer's good-looking resident fonts are draft type and three letter-quality fonts: Courier, Tiempo (similar to Times Roman), and a sans serif font called Gothic. The fonts available on the optional font card are Prestige Elite, Orator, OCR-A, and Gothic. Besides emulating the Epson LQ-2500, the printer will produce the block graphics and international characters of the two IBM extended character sets.

You'll rave about the Allegro 24's paper-handling personality and commend its print quality, but you'll wish its performance were more allegro in tempo. Although the printer danced along at 71.9 characters per second in draft, it dragged its feet in proportional Gothic NLQ (43.7 cps) and 10-character-per-inch Courier NLQ and Gothic NLQ (both 38.8 cps).
—Carol Olsen Day



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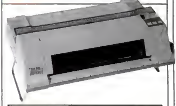


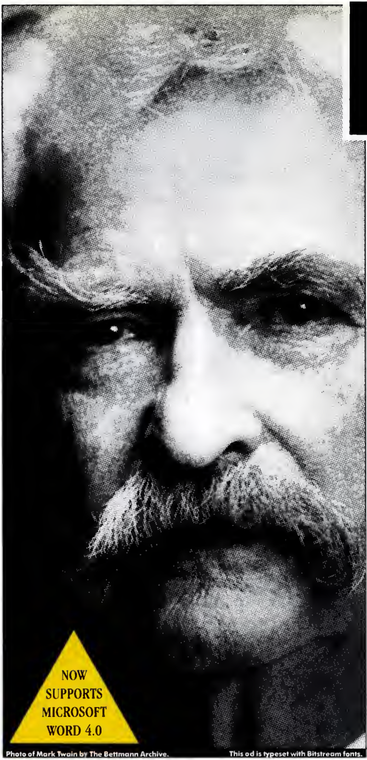
ALPS ASP1000
ALPS America
3553 N. First St.
San Jose, CA 95134
(408) 432-6000
List Price: $299
Dimensions (HWD): 4.25 x 15.75 x 10.5 in.
Weight: 9.0 lbs.
Emulations: Epson FX-85; IBM 5152 Graphics Printer
In Short: The 9-pin ASP1000 is ideal for the economy-minded or as a second printer. A capable performer, it features a flatbed design for a true straight-line paper path and flexible paper handling.
CIRCLE 700 ON READER SERVICE CARD

The ASP1000 from ALPS America is a low-end, narrow-carriage dot matrix printer with an innovative design and versatile forms-handling options. Weighing in at a mere 9 pounds, this capable performer is easy to use and provides a number of features that belie its low price ($299) and diminutive stature.

This printer's most prominent characteristic is its flatbed design. With its 9-pin printhead mounted above the platen, the ASP1000 allows paper to travel in a straight-line path, eliminating most of the usual suspects that cause paper jams.

An adjustable, low-profile push-tractor mechanism and alternate friction feed enable the use of a wide variety of fanfold and single-sheet forms. You will never wish for a third hand when you load this printer. Since the ASP1000 is front-fed and all mechanisms are clearly visible and well located, you don't have to grope for under-the-carriage slots or grapple with rear-feed guides.

Single sheets can be handled easily, without having to remove tractor-fed paper. You just have to remember to switch to friction feed and adjust the form thickness control before loading. Unfortunately, underlying tractor-fed paper advances



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along with single sheets. Since the ASP1000 was not meant for thick, multipart forms, this should not be a really wasteful problem.

Loading the two-piece ribbon cartridge, however, is an easily botched six-step affair requiring plastic tweezers (provided) and close visual inspection of the printhead to ensure proper alignment. These unusual fabric ribbons, expected to last for a million characters, may be tough to locate at discount supply houses.

Aside from the legerdemain required to load ribbons, setting up the ASP1000 is straightforward. Flip-out metal legs (like those of the ALPS Allegro 24) can be deployed to allow storage of paper under the printer. The wide separation of power cord and interface cable allows unimpeded movement of printed sheets to their resting place.

You will need a small screwdriver to open up the DIP switch housing if you want to change the factory settings. The switches allow you to select Epson FX-85 or IBM Graphics printer emulation, control the appearance of the zero character, set page length, and invoke nine other printer modes. The standard 8K buffer can be configured for various character or graphics modes.

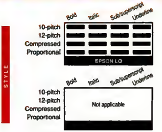
Since it is well written and well organized, the slim manual does not suffer from the lack of an index. It is sufficient for basic use, maintenance, and configuration purposes—although it could be improved by the inclusion of programming examples, especially in the sections dealing with downloadable characters and bit-image graphics.

The ASP1000 will not astound you with blazing print speed. Rated at 120 characters per second in draft mode and 24 cps in letter quality mode, it delivered 47.3 cps and 14.6 cps, respectively, in our testing—a fairly typical degradation considering that printer manufacturers tend to measure "burst" speeds across one line while PC Labs tests the average output over a two-page printout. Print quality is superior to that of many more-expensive printers I've seen.

The ASP1000 should suffice for home and educational applications as is. However, several drawbacks limit the machine's usefulness in business applications. It is a little too loud for use in an open office environment. Its limitation to two-part forms, the inability to tear off printed sheets without some waste, and the lack of a front-panel page-length control preclude its use as a dedicated forms printer.

Considering the price and features of this unit, I can't be overly critical of its shortcomings—apart from its less-than-ideal ribbon. Even with this Achilles heel, if your budget and workspace are tight, the ASP1000 is definitely worth a look.
—Gene Smilgiewicz

ALPS P2424C



How new is new? While some printers in this year's crop have been radically changed to meet the needs of the 1988 market, others have had only a few (albeit potentially important) features altered. The ALPS P2424C printer falls into the latter category.

At $1,495, the ALPS P2424C is an updated version of last year's P2400C color printer and, according to its manufacturer, has had only a few structural alterations. For example, the 24-pin printhead on the P2400C could be switched to an 18-pin alternate. Although the newer model comes with only the 24-pin printhead, it offers an 18-pin emulation. Hence, users whose software requires an 18-pin emulation for graphics can take advantage of a lever that makes the ALPS P2424C emulate the Epson FX/JX family of printers. The machine also now has a buffer of 64K, upgradable to a full 256K.

The printer is certainly meant for heavy-duty work. It is solidly built (taking up quite a bit of desk space in the process); the tractor can be switched to push or pull paper through from the back, or pull it through a slot in the bottom of the printer. The control panel—which takes up the entire front of the printer—includes 12 buttons that cover the usual functions such as on-line, line feed, and form feed; a "memory mode" switch that puts the printer into programming mode; and four switches that enable you to change type style, print mode (draft, high-density, or letter quality), character pitch, and line spacing.

The P2424C comes with a bonus: a RAM-resident package called ALPSmate that lets you change pitch, add print enhancements, and create fonts.

PC MAGAZINE FACT FILE

ALPS P2424C
ALPS America
3553 N. First St.
San Jose, CA 95134
(408) 432-6000
List Price: $1,495
Dimensions (HWD): 6.5 x 25.25 x 23 in.
Weight: 43.7 lbs
Emulations: Epson FX, JX (graphics only), LQ-2500
In Short: This full-featured 24-pin color printer's best points are its speed and its ability to switch into 18-pin graphics mode.

CIRCLE **696** ON READER SERVICE CARD

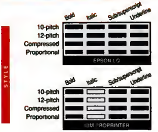
Each button also includes a "host" feature that allows you to override panel settings through your software. The resident font is one of the few features that you cannot change through the front panel; in this case, it is necessary to go into memory mode, where the fonts are listed by number rather than name.

As in many of today's printers, the defaults are altered using panel switches in combination with a menu printed out by the P2424C. You cycle through a number of changeable functions, including color, character pitch, line location, and print mode, by hitting the Menu Select switch; two buttons labeled Next Option and Previous Option run through the options for each feature. Although this system works smoothly for the most part, the P2424C does not advance the paper more than a line when it prints out each feature, compelling you to peer through the cover at the settings.

The printer includes two resident letter-quality fonts labeled Gothic and Courier (extra fonts are available through optional cartridges). The Gothic, a rather bold sans serif typeface, is satisfactory but not spectacular; the Courier is a much thinner, somewhat uneven serif font. While the fonts may not be particularly impressive, the printer's speed is: it clocked in at a very nice 163 characters per second in draft mode and 78.3 cps near-letter-quality.

The P2424C does come with a bonus: a RAM-resident software package called ALPSmate that lets you easily change pitch, add print enhancements, and create downloadable fonts. That, together with the printer's speed and range of features, could make it a good deal, especially for users who need to switch into an 18-pin graphics mode.—**Barbara Krasnoff**

AMT Accel-500



EPSON LQ	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

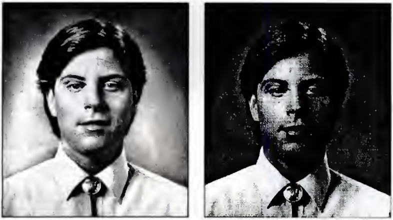
IBM PROPRINTER	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	■	□	■	■
Compressed	■	□	■	■
Proportional	■	□	■	■

The Accel-500 from AMT had so many interesting features in 40 pounds of gray plastic that it was a true letdown when I came across the quirks associated with it. In other words, I was impressed with this high-end 24-pin dot matrix printer—until it started printing.

One feature of the Accel-500 that will strike anyone familiar with dot matrix printers is the intriguing control panel. AMT has taken the idea of printing out settings in the form of a menu and put it on the control panel as a 16-character LCD with a dial. Pressing the setup button and turning the dial makes print parameters appear on the LCD. You can scroll up or down through six major categories and their subheads: operations, print modes, page settings, tabs, communications settings, and special modes.

Just turning the dial allows you to adjust the paper up and down, much the same way a platen knob does. Pressing Alt and then moving the dial lets you move the printhead left and right.

Additional control-panel buttons include font/pitch, mode/emulation, print/LPI, clear/reset, test/status, form feed, line feed, top of form, bail, and paper park.



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These images were printed using Aldus Pagemaker 3.0 using the DPTEK Laserport Card in conjunction with an HP LaserJet Series II. Effective print resolution is 1200 dpi horizontal and 300 dpi vertical.

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CIRCLE 171 ON READER SERVICE CARD

PC MAGAZINE FACT FILE

AMT Accel-500
Advanced Matrix Technology Inc.
1157 Tourmaline Dr.
Newbury Park, CA 91320
(805) 499-8747
List Price: $1,285
Dimensions (HWD): 7.3 x 24 x 18 in.
Weight: 40 lbs.
Emulations: Epson JX, LQ-2500; IBM Proprinter, 5182 Graphics Printer; Xerox 4020
In Short: The Accel-500 is loaded with enough features to put the average dot matrix printer to shame. However, print quality, especially in draft mode, does not nearly do justice to either the price or the 24-pin printhead.

CIRCLE 697 ON READER SERVICE CARD

Primary modes are accessed by pressing the appropriate button, while the alternate modes are invoked when you press Alt and then the key.

No more turning the printer off and on when you change the settings, either. If you decide to change an emulation, the change goes into effect immediately.

While most of us don't gripe about manually moving the paper bail, the printer's bail button allows you to do it from the control panel. The Accel-500 also features paper park, which backs up form-feed paper to the tractors if you need a quick memo on cut-sheet paper.

All of these nifty toys are fine until you get to the printer's main function: printing. At $1,285, the Accel-500 offers one of the worst draft modes I've seen; letters chopped off, variations in print density, and dots so widely spaced you'll wonder if you're really printing on a 24-pin printer. Near-letter and letter quality are better, but the print quality seemed chalky to me: fuzzy letters with edges that bleed into the page.

Text output is speedy, as you'd expect from a printer in this price range. Draft mode was clocked at 182 characters per second in narrow-carriage operation and 242 cps when using a wide carriage. On the other hand, graphics output speed is slow. In Epson LQ emulation the printer averaged 236 seconds on the graphics speed test; in IBM Proprinter emulation, 262 seconds.

A standard feature is a dual parallel/serial interface. Technically, if you are interested, you could hook up two computers to this printer and write software code to switch between PCs. The Accel-500 is a rugged printer that could stand the strain of more than one user.

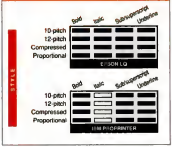
The printer runs off what the company calls an IntelliCard—a device about the size of a regular playing card that slides into a slot in the back of the machine. The IntelliCard contains the information required to run the printer. If you wish to add more fonts, you must purchase a second card for $40 and $15 per font (up to 12 fonts).

The AMT Accel-500 runs off of an IntelliCard—a device about the size of a playing card that slides into a slot in the back of the machine.

This printer is a paradox. It has enough print modes and fonts to qualify it for desktop publishing or sophisticated word processing, but the print quality is too poor to make it a contender yet. Perhaps the key word here is *yet*. AMT has done some interesting things with the Accel-500, but it obviously has a long way to go. If you need a printer right now that can function within a large office or group of users, and your primary printing needs include such things as spreadsheets, where print quality is not a crucial issue, the Accel-500 is a viable alternative. For anything else, the safest option is to wait and see.

—Gretchen Luchsinger

Brother M-1724L



EPSON LQ	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

IBM PROPRINTER	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	■	□	■	■
Compressed	■	□	■	■
Proportional	■	□	■	■

Knowing the excellent reputation of Brother dot matrix printers, I was glad to have the chance to dig into the sleek, 24-pin Brother M-1724L. I discovered that the paper-handling qualities and the control-panel selector in the $949 M-1724L are every bit as good as those of its big brother, the M-2518. The print quality is also quite good.

But the M-1724L can be finicky. A thin belt drive, hidden DIP switches, an irksome ribbon mechanism, and an optional font board (as opposed to a neater cartridge or card design) made me wonder about the unit's suitability in the office environment.

The printer's commendable paper handling features include an easy-to-implement paper-parking function that neatly backs continuous forms out of the active paper path when you want to use single sheet forms. The M-1724L also incorporates a well-behaved internal tractor unit that fed paper smoothly and accurately throughout our testing. And if printing on postcards is your thing, the M-1724L offers a special pressure roller lever to accommodate.

The well-designed front panel membrane keypad allows you to access many print enhancements and font features. The panel operates in two distinct function modes, each accessing a different series of features. By pressing a combination of buttons, you can enable print styles such as italic, underline, and double-high print as well as various pitches. You can even access the optional LQ300 font board's fonts by pressing certain key combinations.

In general, the M-1724L responds well once you overcome some of its basic eccentricities. My initial series of printer self-tests looked like op-art smudge until I learned to tinker with the ribbon guide so that it sat correctly over the printhead. The printer also uses a manual knob to adjust the printhead's distance from the paper. I'd prefer the ease of an automatically adjusting printhead.

The $149 LQ300 font board plugs into a slot on the front of the printer, and I needed to reinstall mine a few times until it sat just right. Again, I prefer the ease of font cartridges or font cards. While the impact of the M-1724L's printhead did not make much annoying rat-a-tat-tat noise, the decibel rating was high (79 dB) because of the whirring of the printer belt.

Twenty-four-pin dot matrix printers are, in theory, a laudable idea. The M-1724L's type has a clean, almost daisy wheel look to it. But in practice there are problems, especially with graphics compatibility. In IBM Proprinter emulation, the M-1724L produced some spurious characters while printing a graphic. The Proprinter emulation graphics were also skewed, with circles stretching into ellipses. In Epson LQ mode there was also a graphics compatibility problem; the printer would not accept our Epson LQ-1500 graphic for output. Part of the compatibility problem is based on the 24-pin printhead design. Brother's pin design uses two sets of 12 pins; most other 24-pin printers use 3 sets of 8.

The Brother M-1724L's optional memory keyboard transforms the printer into an electronic typewriter.

One of the unique features of the M-1724L is the optional memory keyboard, which plugs directly into the printer and transforms it into an electronic typewriter. Not only does this keyboard let you type directly to the printer, but you can select fonts, justifications, pitches, and print enhancements from it. A single-line LCD provides error and mode messages.

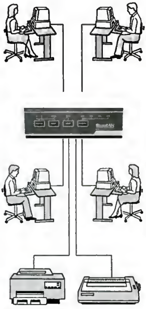
In speed testing, the draft mode was clocked at 98.7 characters per second, and letter quality mode was timed at 49.3 cps.

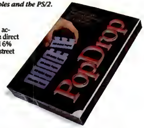
Brother spokespersons told me they are targeting this 24-pin dot matrix printer at those who are retiring their daisy wheel printers in their search for better-looking, more-flexible output. For the price, I'd dig a little deeper and make the jump to lasers.—**Robin Raskin**

PC MAGAZINE FACT FILE

Brother M-1724L
Brother International
8 Corporate Pl.
Piscataway, NJ 01203
(800) 284-2744
(201) 465-6969
List Price: $949
Dimensions (HWD): 4.84 x 12.01 x 20.16 in.
Weight: 18.70 lbs.
Emulations: Diablo 630; Epson LQ; IBM Proprinter XL
In Short: A 24-pin printer with excellent paper-handling capabilities. Its real power becomes apparent when the optional font board with its three additional fonts is installed. Although the printer performs nicely, its high price, less-than-rugged design, and graphics incompatibility make it a questionable choice for the office environment.

CIRCLE [illegible]96 ON READER SERVICE CARD





Brother M-2518

STYLE

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	■	□	■	■
Compressed	■	□	■	■
Proportional	■	□	■	■

IBM PROPRINTER

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

EPSON FX

Dot matrix printers are alive, well, and full of innovations in the world, according to Brother's new $1,295 M-2518. This printer is optimized for rugged office environments where thick multipart forms and volume printing are de rigueur. Brother reports that the printer is so unique, it incorporates a walloping 37 patents.

The M-2518 has an extraordinarily solid feel to it; from the well-fitting paper supporters to the responsive panel buttons to a no-slouch platen knob, the printer is built to last. The hefty wide-carriage body sits atop squat but sturdy legs, allowing you to nestle your paper below and keep a small desktop footprint.

The printer uses an 18-pin printhead technology formed by 2 parallel lines of 9 pins. Unlike other printheads that zigzag their pins to increase the number of dots in the printed character, thereby enhancing the text, the Brother's 18 pins give you the same print quality as a traditional 9-pin printer. But printing is supposed to be faster and the printhead more durable because more pins share the work load.

The M-2518's forte is its paper handling. Brother's patented Paper Express creates a streamlined paper feed, particularly well suited to multipart forms and thick paper. Paper Express is the printer's most distinctive feature, and it works well. Unlike the traditional rear-feed paper mechanism that feeds paper at a 90-degree angle around the platen, this printer's mechanism feeds paper at a strange-looking 45-degree angle (similar to a photocopy machine or a laser printer). The idea

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CIRCLE 522 ON READER SERVICE CARD

PC FACT FILE

Brother M-2518
Brother International
8 Corporate Pl.
Piscataway, NJ 01203
(800) 284-2744
(201) 465-6969
List Price: $1,295
Dimensions (HWD): 7.4 x 24.4 x 10.2 in.
Weight: 30.9 lbs.
Emulations: Epson FX; IBM Proprinter XL
In Short: An 18-pin printer built for durability, the Brother M-2518 features some exciting technology, including a flawless paper feed designed to accommodate thick multipart forms and a pocket-size font card to access three attractive fonts.
CIRCLE **695** ON READER SERVICE CARD

is that a straight, short, flat paper path offers the maximum printhead impact. Another less obvious but equally crucial feature is a self-adjusting printhead.

Other nifty paper-handling features include a paper-parking feature to let you lock continuous form-feed into place and switch over to cut sheets without disengaging the tractor. The printer's user-controllable tear-off function advances a prespecified amount of paper to the paper cutter and then rolls it back to the top-of-form position. Finally, you can individually preset the position of both the cut-sheet feeder bins and the continuous-form tractor in order to print a cover letter, an envelope, and an invoice and have them all correctly positioned.

The M-2518 sports a versatile though slightly overambitious control panel. Virtually every print feature (fonts, print styles, page lengths, paper parking, tear-offs, and character sets) can be accessed through the front-panel settings, but the procedure is confusing. When the cover of the switch panel is closed, you can access all Mode 1 printer functions through the eight buttons on the panel. Open up the panel's cover and you can access two other printer modes, whose functions are selectable with the same set of control-panel buttons.

The printer offers a single built-in Prestige font that is available in draft, near-letter-quality, and letter-quality modes. The font also includes a proportionally spaced mode, but it is a not a true proportionally spaced font. Three optional fonts are offered on a nifty $149 pocket sized font card. The card fits neatly into a slot in the front of the printer and provides Brougham (a handsome Courier), Anelia PS (a true proportionally spaced font), and Gothic (a sans serif font). Other options include a serial interface, an easy-to-install-and-use dual-bin sheet-feeder, and the ability to use a color ribbon.

Contrary to Brother's claim of 360 characters per second, we found the draft print tested at a ho-hum 123 cps, and the noise level was a high 79 dB, although its whirring quality was not particularly offensive. All told, Brother's M-2518 shows every indication of being an office workhorse; it is a welcome addition to the Brother family.—**Robin Raskin**

Canon BJ-130

STYLE	Bold	Italic	Sub/superscript	Underline
10-pitch	■	☐	■	■
12-pitch	■	☐	■	■
Compressed	■	☐	■	■
Proportional	■	☐	■	■

IBM PROPRINTER

STYLE	Bold	Italic	Sub/superscript	Underline
10-pitch	Not applicable			
12-pitch				
Compressed				
Proportional				

If you have discounted ink jet technology in the past, look again. The Canon BJ-130, along with the HP Deskjet, marks a new beginning for ink jet printers. Older ink jets worked well only with special paper, and print quality was mediocre. The new BJ-130 defies comparison with its ancestors. For $1,095, the BJ-130 delivers crisp 360-dot-per-inch graphics and near-letter-quality output that is fine for most applications. The NLQ text speed comes in at a rather speedy 52 characters per second, while draft (the same font printed more lightly) delivers a disappointing 68 cps. With 48 nozzles, the BJ-130 produces text quality as good as or a bit better than the output from the best 24-pin impact printers around.

While print quality on different types of paper is much improved over the previous generation of ink jets, you still have to be careful, and you may have to do a bit of experimenting. For example, if you are using photocopy paper taken from the office copier or laser printer and you load the paper upside down, the ink will bleed all over the place. You may never have realized that there were right and wrong sides to photocopy paper, but you'll know soon enough using this printer. The problem does not occur (and the output looks beautiful) on more expensive rag-bond paper.

PC FACT FILE

Canon BJ-130
Canon USA Inc.
One Canon Plaza
Lake Success, NY 11042
(516) 488-6700
List Price: $1,095
Dimensions (HWD): 5.5 x 24.75 x 14.25 in.
Weight: 26.5 lbs.
Emulations: IBM Proprinter XL, standard; NEC P7 emulation, $55.
In Short: The BJ-130 delivers superb text, very high-resolution graphics, 11- by 17-inch paper capacity, and near-silent 48-nozzle ink jet operation. Anyone looking at 24-pin dot matrix printers should also take a look at the BJ-130.
CIRCLE **644** ON READER SERVICE CARD

You also need to watch out for ink-fixing problems. When we took a drop of water and placed it on a freshly printed page, we had nothing but a blur where data once was. Six hours later, text would still blur unacceptably.

The printer comes with a simple cut-sheet feeding mechanism. Nothing more than a friction mechanism that accepts a stack of paper and pulls sheets one at a time, it worked inconsistently in our testing. Multiple sheet and off-center loading was not uncommon with our somewhat slippery photocopy paper. An optional tractor feed is available for $65.

Graphics were always crisp, and Proprinter emulation yielded 360 dpi with special commands. It remains to be seen, however, whether any applications will provide special support for the BJ-130. With the optional HPGL emulation, you can automatically reach this printer's impressive 360-dpi potential. By using the HPGL emulation software you can create B-size (11- by 17-inch) CADD/CAM drawings that will make your laser-printing friends drool.

Canon uses a large ink cartridge that is separate from the printhead and attached by a tube (unlike the HP DeskJet, which has a small ink cartridge on the printhead).

The BJ-130's graphics were crisp, and Proprinter emulation yielded 360 dots per inch.

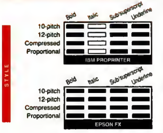
Cleaning is activated from a front-panel button, virtually eliminating the ink-stained fingers that some ink jet users will remember. Ink cartridge life is 2 million characters in draft mode, and replacements cost $18.

The Canon BJ-130 comes standard with Proprinter emulation and a Courier font. NEC P7 emulation is available for $55; Orator and Gothic font cards are available for $95 each. All fonts, including those on font cards, can be conveniently manipulated from the front panel.

In situations where absolute quiet is a must and a laser printer is too expensive or oversized paper is needed, the Canon BJ-130 hits the mark. Put your prejudices about ink jet technology aside and check out this printer. It offers superb text, very-high-resolution graphics, 11- by 17-inch paper capacity, and near-silent ink jet operation—all in one package.

—Philip F. H. Rose

Citizen MSP-40



IBM PROPRINTER	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	■	□	■	■
Compressed	■	□	■	■
Proportional	■	□	■	■

EPSON FX	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

There are always trade-offs in dot matrix printing, so when you can find a printer with a low price tag that lives up to 99 percent of your expectations, you've got a winner. The Citizen MSP-40, with its $499 list price and solid emulations, fills that bill.

The 9-pin MSP-40 comes standard with draft and near-letter-quality fonts in 10 and 12 pitch, with proportional spacing as an option (the proportional spacing looked remarkably close to compressed). Font, speed, and pitch are all easily accessed by the top-front selection panel. Other controls include on-line font cartridge access, and a shared line-feed/form-feed. The optional credit card–style font cartridge is inserted just below the selection panel. Available for $60, it includes a Gothic and a proprietary sans serif font in 10 and 12 pitch. A Citizen America product manager indicated that several more cartridges are in development.

The printer offers two emulations: Epson FX and IBM Proprinter. In Epson FX emulation testing, the quality of the graphics produced was adequate, and the speed was consistent. In the text test, the MSP-40 produced bold, underline, italic, super- and subscript, expanded and compressed print, but no high-order ASCII characters.

In IBM Proprinter emulation mode, the high-order character set was available, but the character formatting omitted italics. Speed results were basically the same as in Epson FX emulation, but the graphics output took nearly twice as long. The sound level topped out at 79 dB.

Printer emulation on the MSP-40 is software or DIP-switch selectable. Setting by DIP switches is easy owing to the convenient right-hand-side placement of the switch panels beneath the parallel port.

The MSP-40's ribbon presented a small problem, though. Throughout a portion of our tests, the ribbon was occasionally slipping out. It turned out that the ribbon was actually lined up incorrectly in a slim metal

PC MAGAZINE FACT FILE

Citizen MSP-40
Citizen America Corp.
2401 Colorado Ave., #190
Santa Monica, CA 90404
(800) 824-9921
(213) 453-0614
List Price: $499
Dimensions (HWD): 6 x 16.5 x 13.5 in.
Weight: 12.5 lbs.
Emulations: Epson FX; IBM Proprinter
In Short: The 9-pin MSP-40 produces 108 cps in draft mode and 34 cps in NLQ. Its small footprint and 12.5 lbs. make it easy to move around the office for nonnetworked sharing. Side-mounted DIP switches offer easy access to hardware selections.

CIRCLE **694** ON READER SERVICE CARD

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Test results available upon request. PostScript is a registered trademark of Adobe Systems, Inc. DDL is a registered trademark of Imagen Corp. Ventura Publisher is a registered trademark of Ventura Corp. Pagemaker is a registered trademark of Aldus Corp guide near the bottom of the designated ribbon slot. Strangely, the print quality was almost the same as when the ribbon was properly adjusted. The ribbon works far too readily in the improper position, and this problem should be avoided entirely by providing only one ribbon-entry path or a nonprint message when the ribbon is slightly misaligned.

The other dot matrix printer plague—paper jams—always looms, but the MSP-40 does offer some relief. You can choose to use single-sheet friction feed or an easily mounted single-sheet feeder. For continuous-sheet paper, you have two more options: there's a dual-utility tractor with pull- or push-through handling. In push position, the tractor hangs off the back of the machine; to convert to the pull position, you pinch two tabs to release the tractor, flip it over, and snap it on top just over the platen. The pull position proved optimal for running continuous paper and avoiding paper jams.

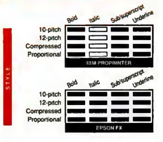
The Citizen MSP-40's emulation is software or DIP-switch selectable. Setting by DIP switches is easy with the conveniently placed switch panel.

Speeds were about average for this class of machine. High-speed draft was clocked at 108 characters per second—slower than Citizen's claimed 240 cps. Regular draft speed was also slower than the claimed speed: 102 cps versus 200 cps. NLQ ran at a consistent 34 cps.

All in all, the MSP-40 performs as it promises, no more and no less. You can now find some 24-pin machines in the same price range, but don't rule out the MSP-40 until you've had a look.

—Tami Peterson

Citizen MSP-55



Citizen America makes nice printers, and the recently released MSP-55 proves this once more. At $829, the MSP-55 competes head-to-head with IBM's Proprinter III XL and Epson's FX-286e and does well in each case, but not well enough to gain a huge presence in the market.

The MSP-55 is a wide-carriage, 9-pin printer with a standard parallel interface. It emulates both the IBM Proprinter and Epson FX series and passed all of our compatibility tests. The machine is a bit light on resident fonts, with only two—a pica and an elite font—each of which can print in multiple pitches, including proportional. An interesting reverse print mode prints white on black; this works well but has a limited practical use. Sans serif and Orator fonts come on optional $60 font cards.

The MSP-55 is a joy to work with. It is lightweight, and the paper-handling controls and mechanics work very well. You can feed paper through the bottom of the printer or the back and can use a convertible tractor in either a push or pull configuration. Switching paper-feed setup is simple and quick.

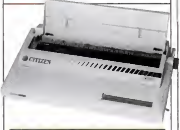
The Citizen MSP-55 has an interesting reverse print mode that prints white on black.

In addition to near-letter-quality and draft modes, the printer has a high-speed-draft print mode that in our tests was about 10 percent faster than normal draft mode. In the IBM Proprinter emulation, the MSP-55 printed 10-pitch type on the wide speed-test sample at 150.7 characters per second in draft mode, 169.9 cps in high speed draft mode, and 44.1 cps in NLQ mode. These speeds are admirable, but the new IBM Proprinter III is significantly faster, attaining 204.8 cps draft, 234.9 cps high-speed draft, and 57.0 cps NLQ.

The MSP-55's 307-page manual is well done, with plenty of programming examples and explanations of how to use the printer with various computers and programs. There are an index and two separate quick-reference cards, one for each of the emulation modes. While many people rarely use printer manuals, even to set up their printers, if you read this manual it can teach you a lot about getting the most from the printer.

The Citizen MSP-55 is joining a very

PC MAGAZINE FACT FILE



Citizen MSP-55
Citizen America Corp.
2401 Colorado Ave., #190
Santa Monica, CA 90404
(800) 824-9921
(213) 453-0614
List Price: $829
Dimensions (HWD): 4.5 x 24.5 x 16 in.
Weight: 17 lbs.
Emulations: Epson FX-80; IBM Proprinter
In Short: The MSP-55 is an attractively designed 9-pin printer. It works easily and well, but there's nothing outstanding about it.
CIRCLE **671** ON READER SERVICE CARD

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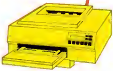

Just connect the PCs together with the supplied serial cable, install the software, and you can share any printer connected to either PC. All printing and file transfers are done in the background, so both PC users can continue working even while their files are being printed or transferred.

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NetLine products are now available through Micro D.

CIRCLE 147 ON READER SERVICE CARD

crowded market already full of strong contenders. This is a fine machine, not one to walk away from, but it doesn't blow any of the industry-standard machines out of the water either.—**Bruce Brown**

Citizen Tribute 124

STYLE

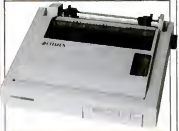
	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	■	□	■	■
Compressed	■	□	■	■
Proportional	■	□	■	■

TOSHIBA 351

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	■	□	■	■
Compressed	□	□	□	□
Proportional	■	□	■	■

DIABLO 630

PC MAGAZINE FACT FILE



Citizen Tribute 124
Citizen America Corp.
2401 Colorado Ave., #190
Santa Monica, CA 90404
(800) 824-9921
(213) 453-0614

List Price: $749

Dimensions (HWD): 5.2 x 16.5 x 14.6 in.

Weight: 14.6 lbs.

Emulations: Diablo 630; Toshiba 351; optional card for Epson LQ and IBM Proprinter, $100

In Short: Impressive print quality, flexible forms handling, facile operation, and excellent construction make this 24-pin model a truly versatile printer.

CIRCLE **693** ON READER SERVICE CARD

If the ever-widening realm of 24-pin dot matrix printers can be divided into three parts, Citizen America's Tribute 124 sits squarely between the high and low ends. Far from being a middling printer, though, this narrow-carriage unit smacks of quality—in its design, construction, and output—and is a viable candidate for those seeking a multipurpose printer to meet demanding requirements.

Located in a recessed compartment below the front control panel, the bank of configuration DIP switches is easily accessible when you are changing the myriad configuration options. The efficacy of Citizen's unorthodox placement of the standard parallel and serial connectors on the right side of the unit, however, is debatable.

The Tribute 124's default emulation is Toshiba. An alternate Diablo 630 emulation for antique-software users is DIP-switchable.

A detailed reference manual and two quick-reference cards help make selection of fonts and attributes through manual controls or custom programs straightforward. With 16 variations of Prestige and Elite fonts (6 selectable from the control panel), you have an abundant choice of pleasing type styles, with a maximum line length of 133 nonproportional characters in the printer's standard emulation.

When it comes to paper handling, the Tribute 124 shines. You can set up its convertible tractor in either a push or pull position and load it from the bottom or rear. Top-entry friction-fed single sheets as well as continuous stock can be autoloaded. With these multiple paper paths and modes, you can easily adjust the Tribute 124 to accommodate its physical location and a variety of media.

This printer would be even more attractive if Citizen offered sheet/envelope feeder options. Alas, none are available. Since the Tribute 124 can handle up to four-part carbonless forms, I would have also liked to see zero-waste tear-off capability. A dead zone of 1½ inches is a bit much, but it can be reduced to 1 inch by manually setting an alternative top-of-form.

The unit's print speed is somewhat turgid compared with like-priced 9-pin printers, but in line with other printers of its class. Set at 10 characters per inch, the Tribute 124 is rated for 200 characters per second in draft mode and 66 cps in letter quality mode. It delivers 102 cps and 52 cps, respectively. With its standard 24K buffer, the Tribute 124 frees your computer almost immediately when printing short or intermediate documents and reports.

Unlike many other printers in its class, the Tribute 124 has Epson LQ-1000/2500 emulation implemented through software. An optional $100 emulation card (which was not tested but would presumably offer faster performance) is available. The emulation kit also contains a 9-pin Proprinter emulation with the full IBM character set.

If it's speed alone you're after, the Tribute 124 may not impress you. Nonetheless, considering its ease of use, versatility, impressive print quality, and expansion options, the Tribute 124 must rank as one of the better buys among 24-pin printers.
—Gene Smilgiewicz

C. Itoh CI-2500

STYLE

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

IBM PROPRINTER

	Bold	Italic	Sub/superscript	Underline
10-pitch	Not applicable			
12-pitch				
Compressed				
Proportional				

So you want to buy a printer for your PC. You have a flexible budget and you want something you can pull out of the box and have running in draft mode in the proper emulation before the hour is out. Steer clear of the CI-2500. If the word *serial* on the box doesn't throw you, chances are the manual's 64 pages on DEC emulation will.

Setting up the CI-2500 was an ordeal that took more time than running all of the benchmark tests. The DTR (data terminal ready) was set on 11 instead of 20, which

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Stephen L. Woolstenhulme,
Parkway Property Management,
Dallas, TX

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PC MAGAZINE FACT FILE

C. Itoh CI-2500
C. Itoh Electronics Co.
2505 McCabe Way
Irvine, CA 92714
(800) 227-0315
(714) 660-1421
List Price: $1,049
Dimensions (HWD): 4.8 x 22 x 13 in.
Weight: 26 lbs.
Emulations: DEC; IBM Proprinter
In Short: Designed more for DEC than for IBM PC environments, this 9-pin serial dot matrix printer will have even the most placid person cursing by the time it is set up. But satisfactory print quality and speed make the printer suitable as a LAN server printer or in multiuser environments that take advantage of the machine's rugged design.
CIRCLE **692** ON READER SERVICE CARD

is common in such non-IBM environments as DEC, but not much help when the rest of your hardware is pure PC.

Once you get through the PC reconfiguration and get the CI-2500 up and running, this 9-pin printer is fairly easy to get along with. A membrane-button front control panel features line-feed (LF) and top-or-form (TOF) buttons and allows you to choose print quality as Function NLQ, Menu LQ, or draft.

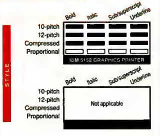
DIP switches are absent on this printer in favor of a menu system. If you press the Print Quality button while turning the power on, the CI-2500 prints out the six major function settings: mode, form length, lines per inch, characters per inch, print quality, and buzzer on/off. This is your only chance to change the factory-set DEC emulation to IBM. The LF button allows you to scroll forward. If you miss a function, the TOF button permits you to scroll back. The latter is a helpful feature often missing from printers that use menus instead of DIP switches. You save your changes by pressing the on-line switch.

The CI-2500 also offers a more detailed menu, accessed by pressing both the print quality and on-line buttons as you turn the printer on. The second menu operates like the first and includes such settings as protocol, slashed zero, and character set.

The printer's speed is rated at 250 characters per second in draft, but our tests measured it at 144 cps on the narrow setting and 157 on wide carriage. The graphics speed test rated the printer at 510 seconds—slower than the proverbial molasses in January. For $1,049, both of these times should be faster. I was not particularly taken by the printer's resident font, but print quality in all three modes is decent. Six additional font cartridges are available for $49 apiece.

Although the the C. Itoh CI-2500 seems to have been originally designed for DEC, it is suitable for the PC environment if you are knowledgeable enough to set it up. It should never venture outside the office, and it should never be expected to take on a heavy graphics load. Look at the CI-2500 if you want three print modes, with optional fonts, and don't mind the average speed for an above-average price.
—Gretchen Luchsinger

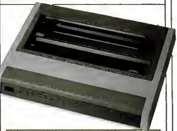
C. Itoh Triprinter CI-5000



The C. Itoh Triprinter CI-5000 is a low, slick, 9-pin printer that produces excellent-quality text at impressive speeds and at a fairly high price.

The $1,995 printer is a versatile machine that allows for different interfaces. Our review unit was designated Model 20, which refers to the PC interface that comes with it as a cartridge. It fits neatly under the back cover. Owners of DEC and Apple computers, or those who want to emulate the C. Itoh line of printers, can fit the machine with different interface cartridges.

PC MAGAZINE FACT FILE



C. Itoh Triprinter CI-5000
C. Itoh Electronics Co.
2505 McCabe Way
Irvine, CA 92714
(800) 227-0315
(714) 660-1421
List Price: $1,995
Dimensions (HWD): 4.75 x 22 x 20 in.
Weight: 38.8 lbs
Emulations: IBM 5152 Graphics Printer
In Short: This is an extremely fast 9-pin printer with good type quality, but its high price and lack of different typefaces may make you think twice.
CIRCLE **691** ON READER SERVICE CARD

The main selling points of the Triprinter seem to be programmability and speed, and it excels in both. The printer hit a rapid 257.6 characters per second in draft mode, dropping to 74.6 cps in near-letter-quality—still a nice speed. And the print quality is excellent for a 9-pin printer: the letters are slim and well defined, if a bit rough around the curves. According to the manufacturer, since the CI-5000 emulates the IBM Graphics Printer, there are no available NLQ control codes; instead, C. Itoh has its own control codes for its NLQ typeface. There is no proportional type.

The printer's defaults are changed using the series of membrane switches that are lined up across the entire front of the printer, along with a small LCD screen. To change a default, you hit a Mode switch

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CIRCLE 173 ON READER SERVICE CARD

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LASER PARTNER

and then type in the number of the function you want to change (for which you must consult the manual) and hit the Enter key. You then type in the value of the new default, press Enter, and hit the Reset button.

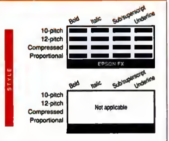
While there are the usual on-line, top-of-form, and line-feed buttons, several of the front-panel switches in the impressive display are there simply to inform you of the current status by flashing it on the LCD. If there is a problem with the printer, the LCD displays an error code, which is explained in the well-written manual.

C. Itoh seems to enjoy selling options that many other manufacturers provide gratis. For example, unlike most printers, which either pull paper from the platen or push it through, the Triprinter's rear-fed tractor holds fanfold paper firmly both as it enters and as it exits the machine (or you can load it from the bottom). If you prefer to be able to tear off your paper as it emerges from the platen (as many of us do), the manufacturer sells an optional tear-bar assembly for $125 that lets you feed the paper up through the cover right after it leaves the platen.

Such extras can push up the price of what is already an expensive printer. But if your quest for high speed with good-quality type is primary, you may still want to give the Triprinter a shot.

—Barbara Krasnoff

Copal Writehand 5930



FACT FILE

Copal Writehand 5930
Copal USA Inc.
2291 205th St., #105
Torrance, CA 90501
(800) 441-7763
List Price: $1,195
Dimensions (HWD): 7.25 x 24.75 x 14.5 in.
Weight: 37 lbs.
Emulations: Epson FX-80; IBM Proprinter XL
In Short: The Writehand 5930 shows promise of giving satisfactory performance, with reasonable speed and high-quality print. Unfortunately, this 18-pin unit offers neither extra features nor a better price to compete with the market leaders.

CIRCLE **670** ON READER SERVICE CARD

With the $1,195 Writehand 5930, Copal USA has taken on a tough assignment, challenging two standard lines. It's easy to compete against standards in the computer industry when they are outdated or overpriced. But with printers, even though much of the news focuses on lasers these days, manufacturers of the dot matrix variety continue to improve on the accepted standards.

Epson continues to update the FX and LQ lines, and IBM's Proprinters are now in their third generation. Both manufacturers' machines were good to start with and get better with time. This near lock on the dot matrix printer market means that competitors have to beat them on either price or performance. The Copal 5930 tries, but it falls short.

The 5930 is an 18-pin, wide-carriage dot matrix printer with a standard parallel interface. Only one typeface comes standard, although it can be printed in 10, 12, and 17 characters per inch or proportional pitch. The near-letter-quality mode produces nice-looking print, but it doesn't match the quality attainable from 24-pin printers. You can create your own fonts and download them into the printer's 8K memory, or use optional $69 font cards, two of which are currently available.

The 5930 offers two standard printer emulations: IBM Proprinter XL and Epson FX. You select the emulation and all other settings via a front control panel with multiple membrane buttons, LED indicator lights, and displays of the current settings. This menu system works quite well once you get the hang of it, beating the Mannesmann Tally 340 system, where you choose options by moving the printhead.

The Writehand 5930 is a competent printer, easy to set up, with both top-rear and front paper feeds as well as a smooth paper-parking feature. An internal tractor also functions smoothly.

In Epson mode, the 5930 attained a speed of 228 characters per second in 10-pitch type on a wide-print sample in draft mode, and 47 cps in NLQ mode. These speeds are respectable, but they're not going to win headlines.

One of the 5930's best features is its operations manual, which manages in a mere 103 pages to cover all the installation, operation, and programming information in a clearly written, well illustrated style. The only thing missing is an index.

> *The Copal Writehand 5930 is a competent printer, easy to set up, with both top-rear and front paper feeds as well as a smooth paper-parking feature.*

If the Writehand 5930 sold for $750, it would be a contender, but at its current list price it costs more than either the Proprinter III XL or the Epson LQ-1050, both of which have long lineages and more standard features. The world does not need this printer at this price.**—Bruce Brown**

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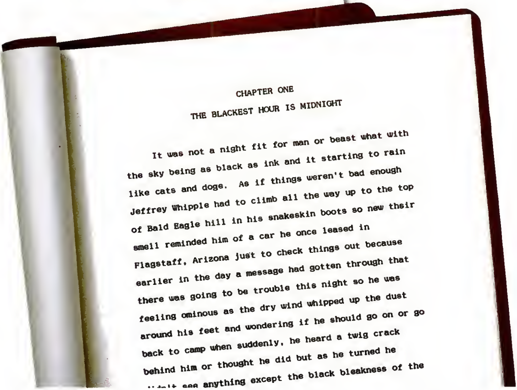

CHAPTER ONE

THE BLACKEST HOUR IS MIDNIGHT

It was not a night fit for man or beast what with the sky being as black as ink and it starting to rain like cats and dogs. As if things weren't bad enough Jeffrey Whipple had to climb all the way up to the top of Bald Eagle hill in his snakeskin boots so new their smell reminded him of a car he once leased in Flagstaff, Arizona just to check things out because earlier in the day a message had gotten through that there was going to be trouble this night so he was feeling ominous as the dry wind whipped up the dust around his feet and wondering if he should go on or go back to camp when suddenly, he heard a twig crack behind him or thought he did but as he turned he see anything except the black bleakness of the

We're sorry that our new 24-wire Pinwriter® P5200 and P5300 printers can't do much for the quality of your writing. But they can certainly do wonders for the way it looks. The secret is the ribbon. Other dot matrix printers only use a fabric ribbon. Our Pinwriters print with both a fabric and a letter-quality, multi-strike film ribbon—the same kind used on executive typewriters.

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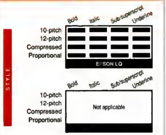
Copal Writehand 6730



Copal's $995 Writehand 6730, a wide-carriage 24-pin printer, is a slightly improved version of the company's older Writehand 6700. The 6730 has both IBM Proprinter and Epson LQ emulations built in, while its predecessor offered either one or the other in a module. The other notable difference between the two printers lies in the printhead. Surprisingly, the new printhead used in the 6730 slows the machine down by as much as 35 characters per second (according to the manufacturer's ratings for draft mode). The company says this is designed primarily to avoid the overheating that tended to occur on the 6700 at high speeds.

Unfortunately, the 6730 can ill afford to lose those 35 cps. Its tested speeds of 110 cps in draft mode and 62 cps in proportional near-letter-quality place it among the slower wide-carriage machines we looked at, leaving it trailing some narrow-carriage units at half the price. It also turned in a slothlike performance on the graphics speed tests, taking twice as long as many cheaper printers.

On the positive side, paper handling is simple on the 6730. The built-in tractor feeder has a paper-parking feature that lets you automatically roll fanfold paper back off the platen or position the top of the page at the printhead. With fanfold paper parked, you can tilt up the paper separator, which doubles as a single-sheet guide, and insert friction-fed single sheets. Unfortunately, the printer lacks any safeguards to prevent you from using the tractor feeder with the paper release lever inadvertently set to friction feed.

Membrane buttons on the front panel let you switch among 10-point pica, 12-point elite, expanded, and condensed type in draft mode. There's also a button for selecting an optional font cartridge, though only two cartridges were available at the time of review. You can make permanent changes to other settings by turning the printer off and then back on while pressing the draft/NLQ selector.

The printed menu is self-explanatory, but the user will probably have to go back to the manual each time to figure out which buttons do what. Separate menu buttons or a separate set of button labels for menu functions would be a big help.

The 6730 offers only two NLQ fonts—pica and elite—but they are reasonably attractive and are supplemented by a wide range of print enhancements. The printer can also produce the high-order ASCII characters, but only in Proprinter mode. It did a good job printing our graphics test file in Epson emulation mode. The Proprinter emulation, however, produced a rather faint image with excessively ragged circles and diagonal lines.

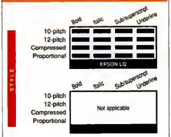
The Writehand 6730's big weakness is its slow speed in both graphics and text mode. Its selection of built-in and add-on fonts may also prove too meager for some users. Apart from this, the printer is an adequate performer, but nothing sets it off from its competitors.—**Robert Kendall**

PC MAGAZINE FACT FILE

Copal Writehand 6730
Copal USA Inc.
2291 205th St., #105
Torrance, CA 90501
(800) 441-7763
List Price: $995
Dimensions (HWD): 5 x 23 x 14.5 in.
Weight: 24.3 lbs.
Emulations: Epson LQ; IBM Proprinter
In Short: The 24-pin Writehand 6730 is quite slow in both text and graphics mode, although it performs adequately in other areas.

CIRCLE **690** ON READER SERVICE CARD

Dataproducts SI 480



Using an unusual solid-ink cartridge, the Dataproducts SI 480 produces beautiful raised print, quietly and fairly rapidly. Dataproducts is positioning this $2,795 printer as a classier alternative for executives and others who don't want to settle for laser-quality type.

The SI 480 is a large unit, 24 inches wide and 32 inches deep including the front-mounted paper tray and rear-mounted wire paper catcher. Fortunately, it's only 8.5 inches high. It is also very quiet during operation.

The solid-ink pellets each come packed in a closed plastic container similar to a single-serving yogurt cup. The container includes a black plastic cartridge cap that fits and screws into an ink reservoir. Before the printer is actually ready to print, this reservoir heats up and melts the ink pellet. The ink is converted to a liquid and then squirted onto the paper via a 32-nozzle print head. The pellets, which have a rated 420,000-character life, come in packages of a dozen for $65.

If the printer isn't used for 2 hours it will revert to standby condition, staying on but allowing the ink to cool somewhat. You can also put the machine on standby manually. If you start sending data to the

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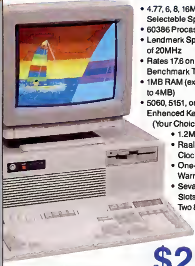

- 4.77, 6, 8, 16MHz Software-Selectable Speed
- 80386 Processor
- Landmark Speed Rating of 20MHz
- Rates 17.6 on Norton's SI Benchmark Test 4.0
- 1MB RAM (expandable to 4MB)
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- 1.2MB Floppy Drive
- Real-Time Clock/Calendar
- One-Year Limited Warranty
- Seven Expansion Slots: Five 16-Bit & Two 8-Bit

Monitor not included

$2095

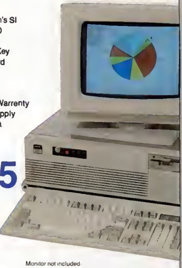
Standard-286/10

PC MAGAZINE Editor's Choice Feb 16, 1988

"Overall, the Standard-286/10 appears to be one of the most attractive values.... It comes with a good complement of manuals and software and performs precisely as you would expect. You should be happy with this one."

— **Alfred Poor**
PC Magazine, Feb. 16, 1988

- 6MHz-10MHz Switch Selectable Speed
- 80286 Processor
- Rates 9.4 on Norton's SI Benchmark Test 4.0
- 512KB RAM
- 5060, 5151, or 101-Key Enhanced Keyboard (Your Choice)
- Clock/Calendar w/Battery Backup
- One-Year Limited Warranty
- 200-Watt Power Supply
- 1.2MB Floppy Drive



$1045

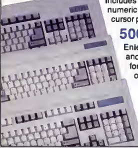
Monitor not included

Standard-286/12

- 6MHz-12MHz Switch-Selectable Speed
- 1MB RAM
- 1.2MB Floppy Drive
- One-Year Limited Warranty
- 0 Wait State Processing
- 5060, 5151, or 101-Key Enhanced Keyboard
- Clock/Calendar w/Battery Backup
- 80286 Processor
- 200-Watt Power Supply

$1245

Keyboards



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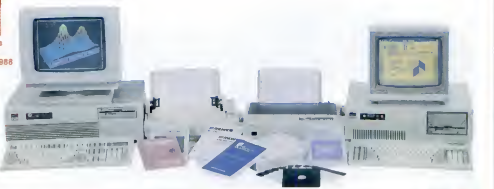
STARTER KITS

PC FullBak
PC MAGAZINE
Editor's Choice
May 31, 1988



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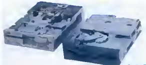

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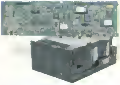

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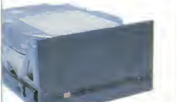

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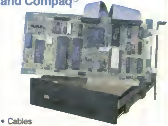

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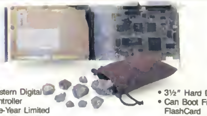

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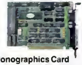
VIDEO AND ADD-ONS

Monographics Video



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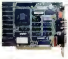

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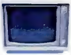

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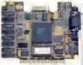

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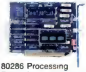

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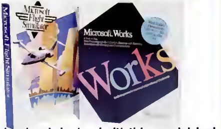

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CIRCLE 294 ON READER SERVICE CARD

FACT FILE

Dataproducts SI 480
Dataproducts Corp.
6200 Canoga Ave.
Woodland Hills, CA 91365
(818) 887-8000
List Price: $2,795
Dimensions (HWD): 8.5 x 24 x 32 in.
Weight: 54 lbs.
Emulations: Dataproducts 8070; Diablo 630; IBM Proprinter, Quietwriter II, 5152 Graphics Printer, 5182 Color Printer
In Short: The SI 480 is an interesting alternative to laser printing, producing beautiful, raised type with a smudgeless ink jet process through its 32-nozzle printhead. It is reasonably fast, very quiet, and positioned as the highest-quality type-producing mechanism on the market.

CIRCLE **687** ON READER SERVICE CARD

printer again, or if you manually take it off standby, the ink takes about 3 minutes to come back up to operating temperature.

Because of the technology of this device, you don't just turn it on and start to print; it takes about 10 minutes to warm up from a cold start. The SI 480 is intended to be left on all day, or even longer. There isn't even an on/off switch; the unit is turned on when it's plugged in.

The SI 480 uses either single sheets in a 215-sheet paper tray or continuous-form paper with a maximum width of 12 inches, including perforations. A lever on top of the printer feeds the paper, single pages going through the top of the unit and multiple pages through the rear into a wire paper catch. Both parallel and serial ports are standard.

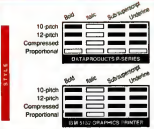
A front menu panel controls paper movement, ink reservoir readiness, and print job parameters. The SI 480 can hold five job parameter settings in memory, to be called up for specific printing tasks.

Dataproducts claims to have over 100 fonts resident, but there are actually only two different standard typefaces, a Courier-like font and a Gothic-like font, each available in either 240 by 240 dots per inch (executive quality) or 480 by 240 dpi (letter quality). The fonts come in 10, 12, or 17.1 pitch and in several national character sets. Dataproducts sells a wide range of font cartridges at $99 each.

The print produced by the SI 480 is first-rate. It looks at least as good as output from laser printers and, because it is squirted on, has a raised, embossed feeling. Don't confuse this unit with typical ink jet printers. The SI 480 works just fine with regular paper and doesn't spread, blot, or smudge. At 157 characters per second in letter quality and 287 cps in executive quality, the SI 480 moves right along.

The SI 480 is the answer to those who complain about laser printer output looking as if it came from a copier. The raised print this unit creates is gorgeous and sure to attract attention. The price is in line with most single-user laser printers as well. If you have the desk space and want very classy print, this is a printer to consider. Because the SI 480 is somewhat unusual, it may meet with some resistance from users, but the print quality is sure to win fans.
—Bruce Brown

Dataproducts 8070 Plus



FACT FILE

Dataproducts 8070 Plus
Dataproducts Corp.
6200 Canoga Ave.
Woodland Hills, CA 91365
(818) 887-8000
List Price: $1,595
Dimensions (HWD): 9.75 x 23 x 13.4 in.
Weight: 40 lbs.
Emulations: Dataproducts P-Series; IBM 5152 Graphics Printer, 5182 Color Printer
In Short: As a color printer, the 18-pin 8070 Plus has possibilities, but it fares poorly when judged solely on its black-and-white text and graphics.

CIRCLE **689** ON READER SERVICE CARD

The Dataproducts 8070 Plus is a third-generation descendant of the IDS Prism printer, which was first introduced in 1981. Thus the design has been around for nearly as long as the original IBM PC. Nevertheless, the 8070 Plus is a new version of this printer, and if it is a dinosaur of sorts, its third-generation status makes it an evolved dinosaur.

The 8070 Plus offers three command sets: IBM Graphics, IBM Color, and Dataproducts P-Series. None of these is represented on the PC Labs benchmark tests. However, an IBM Graphics Printer should follow most commands on the IBM Proprinter text emulation test, and it should be compatible with the IBM Proprinter graphics emulation. The 8070 Plus performed as expected for text, but it failed badly on graphics.

The problem with the graphics is easier to see than to describe. Briefly, each printing line is offset horizontally from the next whenever their leftmost positions vary. This means that if you surround a graphic with a box in such a way that there is a vertical line along the left side, there are no problems. But if you surround it with a circle, or if the graphic consists of several independent pieces, the printing lines do not align properly.

A company spokesman said that he was not aware of this problem, and he was not able to suggest what we might be doing wrong. He also indicated that the printer is designed primarily for color printing, using the IBM Color or Dataproducts P-Series mode.

The problem with the graphics is doubly unfortunate, because the graphics are of unusually high quality when they work. Some extremely detailed patterns turn into solid black, but individual lines of any width are solid and dark. Text output is one notch lower in quality. The 18-pin print head produces fully formed characters for near-letter-quality mode and acceptably readable output for text mode (correspondence quality), but the wiggly characters in draft mode are likely to tire your eyes on long documents.

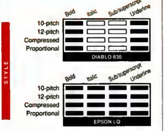
On the speed tests, the 8070 Plus managed over 50 characters per second for both NLQ monospace and NLQ proportional printing on narrow paper. On wide paper, the speed jumped to about 63 cps. Draft quality clocked in at about 192 cps for narrow paper and about 250 cps for wide paper. Correspondence quality mode—which you will probably want to use instead of draft mode for most purposes—managed a respectable 123 cps for narrow paper and 164 cps for wide paper.

The 8070 Plus has a pull tractor that takes paper through a front, rear, or bottom path.

Also on the plus side, the printer has a built-in pull tractor and can take paper through a front, rear, or bottom path. An optional sheet feeder fits under the printer and uses the bottom feed.

Finally, there is the issue of price. At $1,595 list, the 8070 Plus is less than $100 below the street price of an HP LaserJet II. In fairness, keep in mind that this is a color printer. You won't want it for text or black-and-white graphics, but if you're looking for a color printer, don't rule out the 8070 Plus without taking a closer look.—**M. David Stone**

Dataproducts 9044



	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	□	■
12-pitch	■	□	□	■
Compressed	■	□	□	■
Proportional	■	□	□	■

DIABLO 630

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

EPSON LQ

The wide-carriage, 24-pin 9044 heads up Dataproducts' 9000 Series of printers, which also includes a narrow-carriage version of the 9044 and two 9-pin models. As might be expected from its rather modest $1,099 price tag, this printer is not a real powerhouse when it comes to speed and features.

The 9044 sports a built-in bidirectional tractor with a paper-parking facility. With the pin-feed paper parked, you can print friction-fed sheets merely by folding up the paper's cover, which then doubles as a single-sheet paper guide. Dataproducts also offers a single-bin cut-sheet feeder as an option, to which you can add a second bin if you wish. No envelope feeder is available, however.

You operate the printer and modify settings entirely by means of five membrane buttons on the front panel. These let you change the pitch, select draft or near-letter-quality mode, or switch from the current resident font to one of the seven optional font cartridges. LEDs indicate your selections. If you wish to change between the two resident NLQ fonts or alter any other settings, you must resort to a cumbersome affair called the Parameter Menu.

Invoking this menu requires turning off the printer and turning it back on while holding down the font selector button, either alone or in combination with the pitch selector button. The printer responds by printing out the current settings. You then use the top-of-form button, the print quality selector, and the pitch selector in various sequences to print out alternative settings one at a time, from which you can select.

This may beat hunting for semi-inaccessible DIP switches. But if the control panel buttons must do double duty, they should at least have two sets of labels as well.

The 9044's two NLQ fonts (serif and sans serif) are crisp and presentable but not among the most attractive we've seen. In addition, the printer doesn't implement proportional spacing very elegantly; some letters appear cramped while others are strung out a little too loosely. It's also hampered by its inability to print the high-order ASCII set, which includes foreign-language and graphics characters. Dataproducts plans to rectify the latter shortcoming in a new release scheduled for this fall.

The 9044 does offer an exceptionally wide range of print enhancements through

PC MAGAZINE FACT FILE

Dataproducts 9044
Dataproducts Corp.
6200 Canoga Ave.
Woodland Hills, CA 91365
(818) 887-8000
List Price: $1,099
Dimensions (HWD): 5.5 x 23.5 x 14 in.
Weight: 26.5 lbs.
Emulations: Diablo 630; Epson LQ
In Short: The 9044 is a medium-priced, wide-carriage, 24-pin printer that offers undistinguished performance when compared to some other 24-pin models on the market today.

CIRCLE **688** ON READER SERVICE CARD

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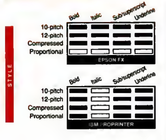
CIRCLE 225 ON READER SERVICE CARD

control codes. These include bold, italic, underline, subscript and superscript, double height and width, compressed type, justification, centering, and horizontal and vertical tabs.

Speed isn't a strong point. We clocked draft mode at 135 characters per second and NLQ at a rather leisurely 74 cps. Graphics printing is even slower. The printer fared well on emulation tests.

The 9044 does have some good things going for it, such as its wide range of software-controllable print enhancements and its convenient paper-parking facility. In most areas, though, it's an undistinguished performer. And weighing heavily against it are its awkward method for changing printer settings, its unaesthetic proportional spacing, and the lack of high-order ASCII characters.—**Robert Kendall**

Diconix 300 and 300w

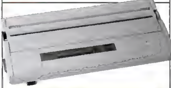


If you've heard of but can't attach any brand-name associations to the phrase "ink jet printer," you are probably among the majority of PC printer users today. The booming popularity of dot matrix and laser printers has eclipsed other categories.

Diconix is one of the few companies that has managed to produce and sell ink jet printers. Springboarding off the popularity of the Diconix 150 portable ink jet printer, the company has decided to take its ink jets one step further with the Diconix 300 and 300w.

At $599 and $749, respectively, these 12-nozzle machines are remarkably light and streamlined, with no obtrusive parts other than the parallel interface and the power switch located—why isn't this done more often?—on the front of the machine. The top control panel consists of raised buttons for form feed, pitch, font selection, line feed forward or backward, and on-line. It would be easy to slide either of these printers onto a small shelf in a crowded office, or into a briefcase.

PC MAGAZINE FACT FILE



Diconix 300 and 300w
Diconix Inc.
3100 Research Blvd.
P.O. Box 3100
Dayton, OH 45420
(513) 259-3100
List Price: Diconix 300, $599; 300w, $749.
Dimensions (HWD): Diconix 300, 2.9 x 9.2 x 14 in.; 300w, 2.9 x 19.0 x 9.2 in.
Weight: Diconix 300, 10 lbs.; 300w, 12.8 lbs.
Emulations: Epson FX; IBM Proprinter, Quietwriter
In Short: While their 12-nozzle printheads' output quality leaves something to be desired, these Diconix printers' speed and unobtrusive sound make them potential favorites both among crowded office inhabitants with infrequent printing needs and among laptop users who want a printer that can easily change locations.

CIRCLE **686** ON READER SERVICE CARD

As for using these printers in an office, I have to wonder about longevity. The machines are well constructed but light enough to suggest that days of medium-to-heavy printing would hasten them to an early retirement. During 4 hours of testing, I went through three ink cartridges. One was defective from the start, and one began to streak the print. The third lasted long enough to allow testing both printers. The claimed cartridge life is 500,000 characters, or about 500 pages, as compared to several million characters for most dot matrix ribbons. Ink cartridges cost $13.95 for plain paper and $11.95 for coated ink-jet paper.

The printers are some of the easiest to use you'll ever see. A manual explains the setup in clearly drawn pictures so that if you know anything about printers, or even if you don't, you'll have the Diconix 300 running 10 minutes after you take it from the box. A set of DIP switches is under the front cover. You can select emulation here as well as line feed, pitch, page length, and IBM character set. Two additional switches under the interface on serial models allow you to set such parameters as stop bits, parity, and data protocol.

Letter quality, near-letter-quality, draft, script, and condensed modes are selectable from the control panel. Text is very light and ragged in draft mode, at a tested speed of 96 characters per second narrow and 131 cps wide carriage. NLQ is suitable for good friends and relatives, clocking in at 38.5 cps narrow and 50 cps wide. The "quality text" lives up to its name in terms of print density, but I found the characters blurry around the edges. Ink jet technology does not deliver the hard-edged characters typical of impact dot matrix machines. Letter-quality speed was measured at 27.5 cps narrow and 22.6 cps wide.

The Diconix 300 and 300w are well stocked with printing and formatting enhancements, although centering, justification, and proportional spacing are available only in IBM mode.

The 300 and 300w are easy printers to use, and the manual explains the setup in clearly drawn pictures.

Perhaps the nicest thing about these printers is their sound: 55 and 56 dBs. Small and quiet is a combination that's hard to beat. If these are your main considerations, and you don't feel strongly about

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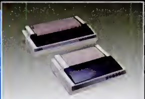
CIRCLE 209 ON READER SERVICE CARD

LIPS II Laser Printer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CIRCLE 349 ON READER SERVICE CARD

print quality or the expense of frequently replacing ink cartridges, the Diconix 300 and 300w are in a class by themselves.
—Gretchen Luchsinger

Epson DFX-5000

STYLE

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

EPSON FX

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	☐	■	■
12-pitch	■	☐	■	■
Compressed	■	☐	■	■
Proportional	■	☐	■	■

IBM PROPRINTER

The Epson DFX-5000 ($2,199) is one of a new class of heavy-duty, extremely fast dot matrix printers being marketed to companies that do extensive data processing. These machines are meant as an alternative to line printers—and, in this case, the alternative is a very good one.

Despite its size (it weighs in at a solid 63 pounds), the DFX-5000 is simple to set up and operate. All that weight contains a 9-pin printhead and an automated system that allows you to switch between two loaded tractor-feeds—one in front and one in back—at the touch of a button.

The front panel contains eight plastic buttons, flush with the panel: on-line, form feed, line feed (load), tear off, micro feed forward and back, top of form, and paper select. The last-mentioned button, which lets you choose whether you want your paper to feed in from the front or rear tractor, also has a neat little graphic of the printer, with LCD arrows showing which tractor is presently in use. There are also power, ready, and paper-out LCD indicators.

Both front and back tractor feeds will accept narrow or wide fanfold paper, and both are very simple to load. Once you have fastened the paper into the tractor feeds under the front panel or threaded it through a slot in the back, you simply close the door and hit the button. The printer pulls the paper in, checks the width, and prepares to print. Once you have both tractors loaded, all you have to do to change paper is simply hit the paper-select button; the printer takes about a minute to retract one type of paper and replace it with the other.

The DFX-5000 produces clear, rounded type in quality about as good as you're going to get from a 9-pin printer. The printer has a limited number of typefaces; it contains draft, proportional, and two types of near-letter-quality fonts: roman (the default) and san serif. There is also a SuperDraft mode, which is chosen through the DIP switches: it resembles the "connect-the-dot" output produced by early dot matrix printers, but speeds along at a sweet 363 characters per second. The normal draft type, which came in a bit slower at 307 cps, was more readable.

One of the most impressive things about the printer is its thorough efficiency. Even the best of dot matrix printers occasionally catches a paper in the platen or loads paper a bit awkwardly. But the DFX-5000 changed from front to back tractor feeds, loaded paper, automatically adjusted for the paper width, and found the top of form with a robotic competence that should make life a whole lot easier for its users.

The DFX-5000 is obviously meant for heavy office use. Its print quality is good but not great; this together with its lack of facilities for cut-sheet paper, certainly does not recommend it for business letters. However, if you have a lot of data processing that you want printed efficiently and quickly, the DFX-5000 is a high-class buy.
—Barbara Krasnoff

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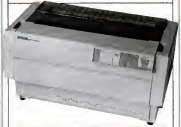


Epson DFX-5000
Epson America Inc.
23530 Hawthorne Blvd.
Torrance, CA 90505
(213) 539-9140
List Price: $2,199
Dimensions (HWD): 14.5 x 26.75 x 14 in.
Weight: 63.34 lbs.
Emulations: Epson FX
In Short: A heavy-duty 9-pin printer that produces dot matrix print at a very impressive speed and switches between two loaded paper tractors with a touch of a button. An excellent choice for a company that has heavy data processing needs.

CIRCLE **685** ON READER SERVICE CARD

Epson FX-850 and FX-1050

STYLE

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	☐	■	■
12-pitch	■	☐	■	■
Compressed	■	☐	■	■
Proportional	■	☐	■	■

IBM PROPRINTER

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

EPSON FX

Some things are as predictable as fireworks on the Fourth of July. That Epson would come out with another sturdy, feature-packed 9-pin printer duo is no surprise.

Both new printers—the $549 FX-850 and the $799 FX-1050 wide-carriage model—belong to Epson's low-end FX series, printers that were traditionally built to be simple to use and to last forever. What sets the new machines apart are their advanced paper-handling capabilities. In the past these were reserved for the more expensive 24-pin LQ series.

A feature called SmartPark gives you paper parking. If you have continuous-feed paper loaded, you can take the printer off-line by pressing the on-line button. You hit the load/eject button on the front control panel, and the paper backs up to the insertion slot across the rear of the machine. You then adjust the paper release lever to the single-sheet position, set the cut-sheet paper on the paper guide which lifts up from the back of the machine, and press the load/eject button again to feed the cut-sheet paper in. This is helpful in situations that require fanfold paper most of the time, with an internal memo occasionally thrown in.

The FX-850 and FX-1050 also include a "short tear-off" feature. This involves setting a DIP switch positioned on the right side of the machines. With short tear-off, the printer feeds continuous paper to the perforation. You tear the sheet off, and the next time you want to print something the paper automatically backs up to the print-head before printing begins. A micro-adjustment feature allows you to adjust the paper by 1/108 inch at a time immediately after you load paper or use the short tear-off.

Both machines have a top control panel with buttons to select your choice of font—draft or the resident roman san serif—as well as type pitch. Separate buttons for form feed and line feed are used when the printer is off-line, or to operate the micro-adjustment feature when the printer is on-line.

FACT FILE

Epson FX-850 and FX-1050
Epson America Inc.
23530 Hawthorne Blvd.
Torrance, CA 90505
(213) 539-9140
List Price: FX-850, $549; FX-1050, $799
Dimensions (HWD): FX-850, 5.9 x 17.9 x 14.2 in.; FX-1050, 5.9 x 24.8 x 14.2 in.
Weight: FX-850, 20.9 lbs.; FX-1050, 27.5 lbs.
Emulations: Epson FX; IBM Proprinter
In Short: Epson's latest releases in the FX series, these two 9-pin printers combine the Epson tradition of sturdy, workaholic machines with advanced paper-handling capabilities previously available only in the more expensive 24-pin LQ series.

CIRCLE **684** ON READER SERVICE CARD

An optional cut-sheet feeder that holds 150 to 185 sheets is available for an extra $199. I found this to be a complicated and bulky apparatus, and setting it up was made more difficult by a manual written in four languages. It's hard to imagine where this feeder would be useful for the desktop PC user. Short memos still thrive on the dot matrix printer; long reports have moved off to laser land.

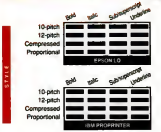
The FX-850 and FX-1050's micro-adjustment feature lets you adjust continuous paper by 1/108 inch after you load paper or use the short tear-off.

The FX print quality isn't bad—obviously the product of a 9-pin printer but solid enough to be comfortable on the eyes: no jerky characters or straggling lines here. The FX-850's print speed is good—if not as good as the Okidata equivalent, the Microline 320—at 138.1 characters per second in draft and 46.0 cps in near-letter-quality roman. The FX-1050 achieved comparable speeds of 1664. cps and 47.3 cps respectively. For both units, graphics speed clocked in at approximately 96 seconds in Epson FX mode and 194 in IBM Proprinter mode—a resonable speed for printers in this class.

I was impressed by these two machines. Although the list prices are a bit high for 9-pin single-user printers these days, potential street prices and the nifty paper-handling features of the FX-850 and FX-1050—as well as Epson's reputation as a manufacturer of high-quality merchandise—ensure that you'll be seeing these printers churning out a range of PC applications in many offices, perhaps including your own.

—Gretchen Luchsinger

Epson LQ-500



Users who want high-quality type from a dot matrix printer are invariably going to look to a 24-pin printer. Those who want a 24-pin printer for under $500 will probably look toward the Epson LQ-500, which delivers good-quality type for less than the usual cost. However, the machine also lacks many of the amenities that most users expect from their printers today.

The Epson LQ-500 is simple to understand and operate. The control panel contains three basic buttons: the on-line toggle, line feed/auto-load (for cut-sheet paper), and form feed. The latter doubles as a select-type switch, which allows you to toggle among up to four typefaces: draft, NLQ roman, NLQ sans serif, and an optional font available through a separately purchased cartridge.

You can reset printer defaults, such as font selection and page length, using the DIP switches that are located under a panel at the side of the printer. You can also use the DIP switches to set up the printer for an optional cut sheet feeder, a unit that fits over the platen and automatically feeds paper in to the back of the platen, then neatly catches it on the other side. This is a handy unit if you have little or no use for printing on fanfold paper, although it will not take a large amount of paper at one time.

The type quality of the LQ-500 is its main selling point, and I found it quite ac-

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▣Generic CADD Level 3 1.01	109.
☐Dot Plot 3.0	35.
Harvard Associates ... NCP	
PC LOGO 2.0	89.
Hayes ... NCP	
☐Smartcom II 3.0	89.
Hilgraeve Software ... NCP	
☐HyperACCESS 3.3	89.
Individual Software ... NCP	
▣Typing Instructor Encore	26.
☐Professor DOS *(with Smartguide)*	33.
Intuit ... NCP	
☐Quicken 2.0	35.
Javelin Software ... NCP	
☐Javelin Plus 2.02	249.
Lotus ... NCP	
▣Agenda 1.0	289.
☐1-2-3 2.01 *(now not copy-protected)*	call
☐Symphony	call
MacroPac International ... NCP	
101 Macros for. 1-2-3 dBASE III Plus WordPerfect Excel	*each* 42.
MECA ... CP	
☐Managing Your Money 4.0	125.
Meridian Technology ... NCP	
☐CarbonCopy Plus 5.0	115.

Micro Logic ... NCP	
☐Tornado 1.8	$55.
Microlytics ... NCP	
☐Gofer 1.0 *(text retrieval* system*)*	45.
☐Wordfinder 4.0 *(electronic thesaurus)*	35.
MicroPro ... NCP	
☐WordStar Professional Release 5	259.
☐WordStar 2000 Plus Rel. 3 *(Personal Ed.)*	259.
Microrim ... NCP	
▣R:BASE for DOS (version 2.1)	449.
Microsoft ... NCP	
☐Learning DOS *(for any DOS version)*	35.
☐Windows 286 2.1	69.
▣Works 1.05	99.
▣Windows 386 2.1	129.
Bookshelf 1.0 w/Amdek Laser Drive	799.
▣Word 4.0	209.
▣Excel 2.0 *(requires 80286/80386 CPU)*	319.
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☐Quick C 1.01	69.
⊞Macro Assembler 5.0	99.
⊞C Compiler 5.1	299.
Migent ... NCP	
▣Ability Plus 1.0	149.
Monogram ... NCP	
☐Dollars & Sense 3.1	105.
Nantucket Software ... NCP	
▣Clipper *(Summer '87, dB3 Plus compiler)*	459.
New England Software ... NCP	
▣Graph-in-the-Box Release 2	75.
Nolo Press ... NCP	
☐WillMaker 3.0	35.
North Edge Software ... NCP	
☐Timeslips III 3.3	119.
Owl International ... NCP	
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Paperback Software ... NCP	
☐VP-Planner Plus 2.0	145.
☐VP-Expert 2.0 *(expert system)*	145.
Paul Mace ... NCP	
☐H/Test-H/Format 2.0 *(hard-disk tools)*	49.
☐Mace Utilities 4.1 *(DOS utilities)*	55.
Personal Computer Support Group ... NCP	
☐Lightning 4.80	57.
▣Lucid 3-D 1.22	89.
Personics ... NCP	
⊞SmartNotes 2.0	49.
⊞SeeMORE 1.0	49.
⊞@BASE 1.1	119.
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▣Norton Commander 2.0	49.
▣Advanced Utilities 1.0	79.
⊞Dan Bricklin's Demo Program 2	99.
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Revolution Software ... NCP	
▣Cruise Control 3.02	39.
Simon & Schuster ... NCP	
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Stone & Assoc. ... NCP *(reqs. graph. brd.)*	
My Letters,Numbers,Words *(ages 2 to 6)*	27.
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Symantec/Turner Hall ... NCP	
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⧉4Word 2.0	59.
⊡Q & A Write 1.01	119.
⊡Grandview 1.0	175.
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☐*Breakthrough* Timeline 3.0	349.
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⧉Scrapbook+	79.
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⊡Desklink 2.0	99.
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☐True BASIC 2.03 *(now includes Runtime)*	57.
⧉Algebra *(includes both I & II)*	32.
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⊡SoftBytes 386 2.53	49.
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⊡WordPerfect Library 2.0	69.
☐WordPerfect 5.0	255.
☐WordPerfect Office 1.0	269.
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⧉Venture Publisher 1.1	549.

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⧉Hardball *(baseball simulation)*	11.
⧉Testdrive *(driving simulation)*	special
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☐Chuck Yeager's Flight Simulator	32.
Infocom ... NCP	
⊡Zork Trilogy	33.
Microprose ... CP	
☐F-15 Strike Eagle *(requires CGA)*	22.
☐Gunship *(requires CGA or EGA)*	32.
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☐Flight Simulator 3.0 *(reqs. graphics brd.)*	35.
Mindscape ... CP	
☐Balance of Power *(reqs. graphics brd.)*	30.
⧉Deja Vu *(reqs. graphics brd.)*	30.
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☐Bridge Parlor *(best Bridge simulation)*	49.
Sierra On-Line ... CP	
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⊡Space Quest II *(requires CGA or EGA)*	33.
⊡King's Quest III *(requires CGA or EGA)*	33.
⊡Police Quest *(requires CGA or EGA)*	33.
Sphere, Inc. ... NCP	
⊡Tetris *(addicting mind teaser)*	24.
⊡Falcon *(F-16 simulation, reqs. graphics brd.)*	32.
Sublogic ... NCP	
☐Jet 2.1 *(requires EGA or CGA)*	33.
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through October 31, 1988

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High Speed Joystick Adapter Card (for IBM PC/XT/XT286/AT/Models 25/30)	$25.
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Manufacturer's standard limited warranty period for items shown is listed after each company name. Some products in their line may have different warranty periods.

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SixPakPlus 64k C/S/P *(now upgrades to 576k)*	129.
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Advantage 2 512k *(for PS/2 Models 50/60)*	call
Advantage 2-386 *(for PS/2 Model 80)*	call
RAMpage Plus 286 512k *(for XT/XT286/AT)*	call
RAMpage! Plus MC 512k *(for PS/2 Models 50/60)*	call
Amdek ... 1 year	
LaserDrive-1 *(CD-ROM Drive; 90-day wrty.)*	629.
Compucable ... 2 years	
2-Position switch box	29.
3-Position switch box	39.
Cuesta ... 1 year	
Datasaver 400 Watt *(standby power unit)*	459.
Curtis ... lifetime	
ACCESSORIES	
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Printer Stand PS-1	18.
Universal System Stand SS-3	25.
DS-1 Switch Box *(controls 2 printers)*	33.
CABLES	
Smartmodem-to-PC Cable *(9 feet)*	17.
Printer-to-IBM cable *(9 feet)*	17.
SURGE SUPPRESSORS	
Safestrip SP-3 *(6 outlets; 1 year wrty.)*	21.
Diamond SP-1 *(6 outlets)*	32.
Ruby *(6 outlets; EMI/RFI filtered; 6 ft cord)*	59.
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DCA ... 1 year	
Irma 2 *(3270 emulation board)*	729.
Epson ... 1 year	
We are an authorized Epson Service Center.	
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LQ-500 *(80 col., 180 cps, 24 pin)*	call
LQ-850 printer *(80 col., 264 cps, 24 pin)*	call
LQ-1050 printer *(136 col., 264 cps, 24 pin)*	call
LQ-2550 printer *(136 col., 400 cps, 24 pin)*	call
LX-800 printer *(80 col., 180 cps, 9 pin)*	call
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2400 Baud Internal Modem	149.
5th Generation ... 1 year	
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Logical Connection 512k	499.
Hayes ... 2 years	
Smartmodem 1200	299.
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Smartmodem 1200B *(no software)*	265.
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Network Card Plus *(with TOPS DOS)*	349.
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Inboard 386/AT 0k *(req. installation kit)*	949.
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High Speed Joystick Adapter Card	special
KYE International ... lifetime	
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Logitech ... lifetime	
Series 2 Mouse *(for PS/2 50/60/70/80)*	65.
HiREZ Mouse *(bus only)*	89.
Mouse w/Paint Show *(bus or serial)*	95.
Mouse w/LogiCAD *(bus or serial)*	119.
Microsoft ... lifetime	
SPECIFY BUS OR SERIAL VERSION	
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Mouse with Windows and Paintbrush	145.
Migent ... 1 year	
Pocket Modem *(1200 baud, incl. software)*	119.
MSC Technologies ... lifetime	
SPECIFY BUS OR SERIAL VERSION	
OmniMouse w/Designer Pop-up menus *(serial only; 1 year warranty)*	57.
PC Mouse w/PC Paint +	89.
PC Mouse w/Autosketch	105.
NEC ... 2 years	
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NSI Logic ... 3 years	
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PC Power & Cooling Systems ... 1 year	
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Turbo Cool 200 *(run 30° - 45° cooler)*	169.
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Breakthrough 286 Accelerator Board *(12 MHz)*	449.
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1200 Baud Internal Modem *(w/ProComm)*	$69.
1200 Baud External Modem *(mini)*	79.
2400 Baud Internal Modem *(w/ProComm)*	159.
2400 Baud External Modem	189
Princeton Graphics ... 1 year	
Ultrasync *(supports CGA, EGA, VGA)*	549.
Toshiba ... 1 year	
P321SL printer *(80 col., 216 cps, w/tractor)*	529.
T1000 Laptop *(80C88, 6.4 lbs., 5 hr. battery)*	call
T1200 Laptop *(80C86, 10 MHz, 20 Meg)*	call
T3200 Laptop *(80286, 12 MHz, 40 Meg)*	call
T5100 *(80386, 16 MHz, 40 Meg)*	call
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Video 7 ... 2 years	
VEGA Deluxe *(supports 640x480)*	219.
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FastWrite VGA	399
VRAM VGA	529.

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Bernoulli II Dual 20 Meg External *(5¼")*	1659.
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PC2B Card *(bootable card for PC/XT/AT)*	229.
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Verbatim Datalife *(10 disks per box)*	22.
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Sony *(10 disks per box)*	18.
Fuji *(10 disks per box)*	19.
Maxell *(10 disks per box)*	20.
3½" DS/High-Density Diskettes *(1.44 Meg)*	
Sony *(10 disks per box)*	55.
Fuji *(10 disks per box)*	55.
Maxell *(10 disks per box)*	59.

MISCELLANEOUS

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CompuServe Information Service	24.
Grolier's OnLine Encyclopedia	32.
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Parallel Printer cable *(15 feet)*	19.

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Back when the IBM-PC was still a gleam in some engineer's eye, the inhabitants of Marlow, NH (pop. 555) already knew the value of getting a glow on. Nothing like a little luminosity to brighten up your day. So, whether we're polishing the pick of our local crop, buffing the bumpers on our buggies and bikes, or preparing your peripheral for packaging, we make sure that everything we do radiates perfection. Inside and out.

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What's this about free macs?

At PC Connection we know that all that glitters need not be sold. Some of it should be given away. Like this month's delicious offer. An assortment of premium macs and other apples from nearby glitzy groves, packed in a classy, made-in-New Hampshire gift crate. It's free with any order of $500 or more between now and November 30.

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How about these apples? Packed in an old-style wood box with slide cover, featuring our delectable mascot. Offer not available to net accounts. Offer good in Continental U.S. ONLY. One per customer.

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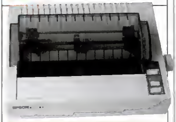
ceptable. The printer's roman font was clear and suitable for most uses, but I found the sans serif a bit too bold to consider for business correspondence. The printer's graphics were clear and well defined.

In its push to drop the price of the printer, Epson left out several features that most business users will miss. For example, you can't use the printer to produce labels or envelopes, and this is a definite handicap in an office machine. There is no way to set the top of form except by shutting off the machine and scrolling the paper to the appropriate point, then turning it back on.

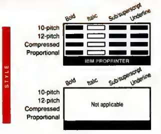
I found the most inconvenient and time-consuming feature to be the tractor feed. Because the LQ-500 uses a pull unit, the pin feeds eject a couple of inches of extra paper, causing you to lose a sheet every time you finish a document. And you not only have to remove your fanfold paper if you want to use cut sheets, you have to remove the tractor feed as well; there are even two covers, one for printing on cut sheets and one to accommodate the tractor feed. If you're on a limited budget and feel the need for 24-pin-quality type, then you may want to consider the LQ-500. But the printer's limitations make it inappropriate for anyone with another hundred or two to spend.—**Barbara Krasnoff**

FACT FILE



Epson LQ-500
Epson America Inc.
23530 Hawthorne Blvd.
Torrance, CA 90505
(213) 539-9140
List Price: $495
Dimensions (HWD): 6.25 x 15 x 14.5 in.
Weight: 15 lbs.
Emulations: Epson LQ
In Short: This inexpensive 24-pin printer would make a nice backup machine, but its awkward paper-feed mechanism and lack of support for envelope and label printing limit its business use considerably.
CIRCLE 683 ON READER SERVICE CARD

Epson LQ-950



If you need a printer that doesn't take up too much room but can print wider spreadsheets than an 80 column printer can, Epson has come to the rescue.

The $949 LQ-950 is an in-between model, aiming for a part of the 24-pin printer market that Epson believes is large enough to warrant an odd-sized printer.

Actually, this machine's width, the major feature that distinguishes it from the LQ-850 and LQ-1050, makes a lot of sense. The widest paper it can print on is 13 inches for single sheets and 12 inches for fanfold paper—the same as many letter-quality printers. This contrasts with the LQ-1050's maximum paper width of 16 inches.

So you can't use superwide computer paper, but if you use single-sheet friction-feed you can still feed regular copy paper sideways. With no margins, printing on 11-inch-wide paper gets you 110 characters at 10 characters per inch or 165 at 15 cpi. At a standard spreadsheet column width of 9 characters, that means you can get three more columns on a sheet with 10-cpi type and four more columns with 15-cpi type than if you used the more typical 8½- by 11-inch paper. And the printout fits in a standard letter-size folder.

Unpacking, installing, and configuring the LQ-950 is identical to the process for the earlier LQ models; it's straightforward, simple, and well documented by the user manual. The only oddity is that this printer, which comes with both parallel and serial ports standard, employs a round 6-pin serial cable connector rather than the more normal 25-pin plug.

There is an internal push tractor as well as friction-feed capability. The paper parking feature works well, so you don't waste fanfold paper when printing single sheets, and paper curl is prevented.

The LQ-950 moves right along, attaining a 10-cpi speed of 127.9 characters per second in draft mode and 61.7 cps in letter quality mode. The near-letter-quality fonts, roman and sans serif, are about as good as you'll get with modem dot matrix printers, which means darn good. Each NLQ font can print in 10-, 12-, and 15-cpi sizes as well as proportional print; draft mode doesn't have a proportional printing

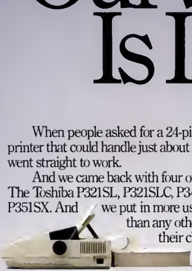
FACT FILE

Epson LQ-950
Epson America Inc.
23530 Hawthorne Blvd.
Torrance, CA 90505
(213) 539-9140
List Price: $949
Dimensions (HWD): 6 x 21.5 x 16 in.
Weight: 22 lbs.
Emulations: Epson LQ-1500
In Short: Epson's LQ-950 joins the company's successful 24-pin LQ line, focusing on a specific niche: spreadsheet users who want wide printouts on regular sized paper. Using 11-inch-wide paper and 15-cpi type, you can print spreadsheets or other reports up to 165 characters wide. This printer also will handle wider envelopes (up to 13 inches) than the LQ-850.
CIRCLE 682 ON READER SERVICE CARD

Our Standard Is Loaded.

When people asked for a 24-pin dot matrix printer that could handle just about anything, we went straight to work.

And we came back with four of them. The Toshiba P321SL, P321SLC, P341SL and P351SX. And we put in more useful features than any other printers in their class. Our fanfold bypass, for instance, lets you print single sheets without having to unload your continuous form paper from the built-in tractor. And our simplified front panel makes printing as easy as touching a button.



There's even an optional automatic envelope feeder on our P351SX. All of which improve the way you handle paper. To improve the way you look on paper, our multistrike film ribbon produces dark, crisp type, no matter which model you buy. Our 360x360 dpi graphics offer a higher resolution than most laser printers. And you can do it all in color with our P321SLC. Or our P351SX with its optional color kit.

Also standard is a wide array of resident fonts and emulations for virtually all software. Not to mention our unsurpassed 24-pin print quality. All with a speed of up to 360 cps for draft and 120 cps for letter quality.

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P321SL/P321SLC

P341SL

P351SX

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TOSHIBA

Toshiba America Inc., Information Systems Division

CIRCLE 321 ON READER SERVICE CARD

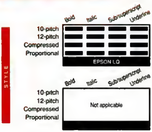
option. Optional font cards for Courier, Prestige, Script, and OCR-B type are available now and cost $59 each. The printer has two slots for font cards, so you can have four accessible NLQ fonts at once.

The SelecType control panel gives you easy access to selecting font, pitch, and condensed print as well as the more usual line feed, form feed, on-line, and paper load/eject buttons.

This printer's only emulation is the LQ emulation, a reassuring industry standard.

The LQ-950 makes a lot of sense for spreadsheet users and others who want a convenient, easy-to-use, and reasonably fast dot matrix printer that combines the precision of 24-pin type, Epson's LQ series quality, and a clever capability for special paper width.**—Bruce Brown**

Epson LQ-2550



PC MAGAZINE FACT FILE

Epson LQ-2550
Epson America Inc
23530 Hawthorne Blvd.
Torrance, CA 90505
(213) 539-9140
List Price: $1,499
Dimensions (HWD): 8.5 x 26.5 x 21 in.
Weight: 44 lbs.
Emulations: Epson LQ-1500
In Short: Epson's top-of-the-line 24-pin LQ series printer is fast, has seven resident fonts, handles paper like nobility, and gives great print—even in color.

CIRCLE **681** ON READER SERVICE CARD

The Epson LQ-2550, the latest in the company's 24-pin dot matrix LQ series, is by far the best yet. At $1,499, consider it Epson's top gun.

The printer, which comes with both Centronics parallel and 25-pin serial ports standard, is a color-capable, wide-carriage model with more resident fonts than most of us will ever use, along with an advanced control panel that automatically detects and adjusts for paper thickness.

Setting up the printer is simple, thanks partly to the clear illustrations in Epson's manuals. The only choice you might need to make is where to put the printer: at 26.5 inches wide and 21 inches deep, it's not small. If the unit is replacing another wide-carriage printer, this should be no problem, but check anyway.

Continuous form paper up to 16 inches wide can be used with the LQ-2550. You can select among tractor, friction, or single sheet feed directly from the front control panel. The built-in tractor feed is of the push variety but an external pull tractor is available for $59. Another option is a $449 dual-bin cut sheet feeder that holds 150 sheets of 22-pound paper per bin.

In our tests, the LQ-2550 printed wide columns of 10-character-per-inch text at a rate of 181.5 characters per second in draft mode and 75.3 cps in near-letter-quality mode. NLQ proportional type is a speedy 91.8 cps.

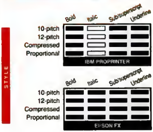
Epson doesn't like to consider draft mode a font (as with the other LQ series printers, the default is NLQ mode). So if you don't count draft, there are seven fonts resident in this printer. They include roman, sans serif, Courier, Prestige Elite, Script, OCR-A, and OCR-B. Most of the fonts print in a variety of sizes, and both roman and sans serif fonts can print in proportional mode. If you really need them, other fonts are available on $59 font cartridges.

While you will know that LQ-2550 output did not come from a laser or daisy wheel printer, many might not be able to tell. The print is clear and pleasant to look at. The LQ-2550 doesn't emulate anything other than the LQ standard.

The control panel is one reason this printer is a step above the lower-echelon LQ-850, 950, and 1050 printers. The front-mounted panel includes buttons, lights, and a 16-character LCD. By using the buttons in combination, you can select paper handling, font, pitch, and other options. You can also advance the paper by line or form and control paper parking from the panel.

The LQ-2550 isn't cheap, and it isn't petite. But this printer is all set to be an office workhorse, pumping out quickly and beautifully the kind of output most of us want to produce.**—Bruce Brown**

Fujitsu DL5600



Fujitsu makes a full line of dot matrix printers, most of which have loads of features. At $2,195, the DL5600 is the vendor's top-of-the-line 24-pin model. It produces handsome type extremely quickly and includes several emulations and usable resident fonts.

The DL5600 is a fairly large printer, over 2 feet wide and almost as deep. At 45.2 pounds, it's also heavy. A look inside the printer, however, reveals that the size and weight come from solid, rugged components. We don't do a drop test, but this

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one looks as if it's built to last. Both Centronics parallel and 25-pin serial ports come standard.

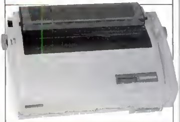
Speed is what most people look for first in a printer, even when their application doesn't require high-speed printing. The Fujitsu DL5600 delivers as much as most users could want, racing away at a rate of 275.4 characters per second in draft 10-character-per-inch printing and 87.8 cps in near-letter-quality. The boldface proportional type is especially fast for a presentation-quality font, at 135.4 cps. While the DL5600 speeds along, it doesn't make a lot of noise, registering only 76 dB in our sound test.

The DL5600 emulates the IBM Graphics Printer, IBM Proprinter, Epson FX-80, Diablo 630, and Fujitsu DPL24. With the $200 color option, the DL5600 also emulates the Epson JX-80 color printer.

Resident fonts include Courier, Prestige Elite, boldface proportional, draft, and compressed. Font cards are available as options, as are single-, double-, and triple-bin sheet-feeders. With the color option, the seven-color ribbon allows printing black as well as color text and graphics without changing ribbons.

With the color option, the DL5600's seven-color ribbon allows printing black as well as color text and graphics without changing ribbons.

FACT FILE



Fujitsu DL5600
Fujitsu America Inc.
3055 Orchard Dr.
San Jose, CA 95134
(408) 946-8777
List Price: $2,195
Dimensions (HWD): 8.5 x 25.5 x 20.5 in.
Weight: 45.2 lbs.
Emulations: Diablo 630; Epson FX-80; Fujitsu DPL24C; IBM Proprinter, 5152 Graphics Printer
In Short: It costs as much as a laser printer, but the 24-pin Fujitsu DL5600 delivers everything you could want in a dot matrix printer—and more. It's terrifically fast and has several good emulations along with four well-chosen resident fonts, and it prints better than you would believe possible with a dot matrix printer. Additional options let you set this machine up for a wide variety of uses, including color printing.

CIRCLE 669 ON READER SERVICE CARD

The print quality obtained from the DL5600 is what 24- pin printers are all about. This printer competes with all other 24-pin printers and beats many of them.

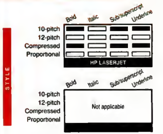
The DL5600 takes paper from the rear with a bidirectional, push-pull tractor. Paper loading is fairly easy, and the printer has a tear-off bar for removing continuous forms neatly.

The Fujitsu's control panel is mounted on the front of the printer and includes a 16-character LCD display, four LED indicators, and a series of setting buttons. The panel controls virtually all hardware settings, emulations, fonts, and page and character parameters. You can save two complete parameter settings in nonvolatile memory for later use. And depending on the printer emulation you are using, you can also control the printer's functions through software.

The documentation is good, including a quick-start section for those who hate manuals, an index, and a foldout menu that shows the arrangement of all printer function and feature settings available from the control panel.

At $2,195 for the black-print-only version and $2,395 for the color version, the DL5600 is not inexpensive. It's fast enough for multiple users, however, and fancy enough for the pickiest of computer fanatics who want a printer that can do just about anything.—**Bruce Brown**

Hewlett-Packard DeskJet



	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	□	□	□	□
Compressed	■	□	■	■
Proportional	□	□	□	□

HP LASERJET

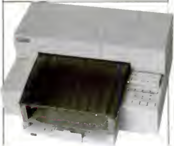
	Bold	Italic	Sub/superscript	Underline
10-pitch	Not applicable			
12-pitch				
Compressed				
Proportional				

The HP DeskJet, along with the Canon BJ-130, represents a new generation of ink jet technology. With resolution at 360 dots per inch and improved printing technology, the $995 DeskJet bears virtually no resemblance to its predecessor, the ThinkJet. Instead, the DeskJet is more akin to HP's excellent PaintJet.

One thing the DeskJet does not share with the PaintJet or the Canon BJ-130 is conventional paper handling. With both the DeskJet and the Ruggedwriter, Hewlett-Packard has tried to distance the user from the paper handling (as if these machines were laser printers), but with mixed results. Don't try to figure out how the DeskJet moves paper; just trust that it didn't jam on us during the testing period. After loading a sheet from the 100-sheet input tray and printing, the DeskJet holds the page in two little arms that reach in from the sides of the output tray for 3 seconds while the ink dries. The little arms then retract and the page floats gently down into the output tray. It works, but there must be a simpler way.

The extra time added by the paper-handling mechanism drags print speeds down to 49 characters per second in near-letter-quality and 61 cps in draft. Where the NLQ speed is good, the draft speed is disappointing. Since the two speeds are so

FACT FILE



Hewlett-Packard DeskJet
Hewlett-Packard Co.
1820 Embarcadero Rd.
Palo Alto, CA 94303
Contact your local Hewlett-Packard sales office.
List Price: $995
Dimensions (HWD): 8 x 17.3 x 14.8 in.
Weight: 14.3 lbs.
Emulations: HP LaserJet; Epson FX optional
In Short: For small-scale desktop publishing applications or for sharp-looking memos and letters, the DeskJet does a good job, but its expensive maintenance costs may make a low-cost laser printer (perhaps the HP LaserJet Series II) a wiser buy for the long run.
CIRCLE **624** ON READER SERVICE CARD

close and NLQ looks so much better, you will probably use it most of the time.

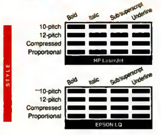
Odd-sized paper up to 8½ inches wide can be hand-fed. With the manual-feed mechanism, it is difficult to feed a page in absolutely straight, and you can't use the old typist's trick of lining the top and bottom of the page up against each other because the end of the page is hidden deep inside the printer.

Text print quality is at least on a par with that of the best 24-pin dot matrix printers, and any program that has HP LaserJet support should be graphics compatible with the DeskJet—a strong point in its favor. While print quality is impressive for a dot matrix printer and remarkable for an ink jet, it is not a replacement for a laser printer in many applications, despite what HP says about the machine's capabilities.

Following the tradition of the all-in-one toner/drum used in the HP LaserJet, the DeskJet uses ink that comes in a small, disposable ink cartridge/printhead combination—unlike the Canon BJ-130, which uses a large ink cartridge attached to a permanent printhead. The result is that the DeskJet is more expensive to maintain. Using the formula we devised to estimate long-term expenses (see the sidebar "The Hidden Costs of Printing"), the ink/printhead cost over 5 years of heavy NLQ use would be approximately $3,750, compared to approximately $1,800 for the Canon BJ-130. The total 5-year cost of buying and operating the DeskJet is about $6,750—almost the same as an HP LaserJet Series II. This formula assumes steady office use; if you print fewer than ten pages a day, the ink cost will be less of a factor.

For very small-scale desktop publishing applications or for test runs of output destined for a laser printer, the DeskJet does an excellent job. For office use, its smart-looking memos and letters may convince you to overlook its idiosyncrasies. But if you have heavy printing needs, consider the HP LaserJet Series II or another low-cost laser printer instead. It will cost about the same over time, and the output will be better overall.—**Philip F. H. Rose**

Hewlett-Packard RuggedWriter



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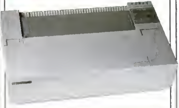


Hewlett-Packard RuggedWriter
Hewlett-Packard Co.
1820 Embarcadero Rd.
Palo Alto, CA 94303
Contact your local Hewlett-Packard sales office.
List Price: $1,695
Dimensions (HWD): 8.2 x 23.6 x 13.7 in.
Weight: 35 lbs.
Emulations: Epson LQ-1000; HP LaserJet
In Short: Designed for heavy use, the wide-carriage RuggedWriter can handle diverse office printing needs. With 24-pin quality, a 173-cps draft speed, and solid construction, it has all the elements of success.
CIRCLE **621** ON READER SERVICE CARD

Designed for the small-business and small-workgroup market, the $1,695 24-pin Hewlett-Packard RuggedWriter can handle all office printing needs and stand up to heavy use. It can print most correspondence acceptably using a very speedy 133-character-per-second near-letter-quality. And with its equally impressive 173-cps draft speed, rugged design, and wide carriage, it can meet the challenge of an office full of spreadsheets and four-part invoices.

The least you can say about the paper handling is that it's complete. Paper can be loaded in continuous form, as hand-fed cut sheets, or from an optional ($250) 100-page cut-sheet cassette. Continuous-form paper loads into an overhang at the bottom front of the printer; thus you *must* place the RuggedWriter at the front of a table, with no obstructions before it. This design allows a straight-through paper path without requiring a special table for bottom feed, but it limits your choices when you're finding the printer a place to sit.

If you use the cassette feed, you will never see—let alone touch—the paper until it emerges complete. Even with continuous-form and single-sheet feed, the user is protected from viewing the ugly workings of the printhead. Why HP hides the printhead is unclear, but it seems to follow their philosophy of protecting the user

MENU
A1
Worksheet Range Copy Move File Print Graph Data System Quit
Global, Insert, Delete, Column, Erase, Titles, Window Status, Page
A B C D E F G H
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
-Aug-87 11 00 AM

Weekly Sales Summary
$(000's)

	Week 1	Week 2	Week 3	Week 4	Week 5
Product A	360	400	225	300	350
Product B	110	120	200	150	225
Product C	180	160	240	320	540

Quick–turn the page.

from having to know what is going on in there. Automatic paper loading and top-of-page positioning work well, but the lack of visual feedback and easy control when problems occur can be a source of frustration.

Hewlett-Packard has virtually guaranteed software support by providing both HPCL (the control language of the HP LaserJet) and Epson LQ-1000 emulation in the RuggedWriter. HPCL's advantages over the LQ emulation on a dot matrix printer are hard to see, but this language may be convenient in an environment with other printers, including HPCL-compatible laser printers. Although you probably would never want to, you could print out the same HPCL graphic (very slowly) on your RuggedWriter or on your HPCL laser printer, as long as it was a 150-dot-per-inch image. The RuggedWriter cannot print 300-dpi HPCL graphics, since its maximum resolution is 180 by 360.

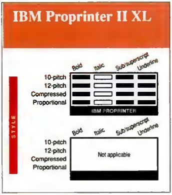
Draft and Courier fonts are standard, and an optional font cartridge ($150) adds Times Roman, Helvetica, Letter Gothic, and Prestige Elite. Since this selection of fonts does not correspond to a LaserJet cartridge, software that has specific drivers for laser cartridges cannot gain access to these fonts. For these packages (*Microsoft Word* and *Windows* among them), HP recommends using the Epson LQ emulation.

Buttons for font selection, print quality, paper-path selection, form feed, and line feed in both directions are on the control panel, which is on the top of the printer in the right-rear corner. This positioning is less convenient than having the controls near the front, but necessary since the entire front half of the printer case swings up and back to provide access to the tractor-feed mechanism and printhead.

The least you can say about the Rugged-Writer's paper handling is that it's complete.

The HP RuggedWriter is a solid and versatile performer. Some will find the odd continuous-paper-feed system and the lack of easy access to the printhead and paper transport annoying, but in an office environment with diverse needs, its versatile design and rugged construction make it a strong choice.—**Philip F. H. Rose**

IBM Proprinter II XL



IBM PROPRINTER	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	■	□	■	■
Compressed	■	□	■	■
Proportional	■	□	■	■

Even in the midst of technological revolution, some of us find comfort in familiarity. If that is your mind-set, then you may want to consider the $799 IBM Proprinter II XL, which is as reassuringly old-fashioned as lemonade on the front porch. And it's not bad at printing, either.

The Proprinter is a square-built, wide-carriage, 9-pin printer that works solely in IBM's Proprinter emulation. Like most of the Proprinter line, it produces basic dot-matrix type with few complications.

For example, the front panel has only three switches: the on-line button, the line-feed button, (which also puts the printer into quiet mode when the printer is on-line), and the form-feed button, which toggles the printer between near-letter-quality and draft print when on-line (making the Proprinter one of the few printers that change print type in the middle of a job).

While you can permanently change printer defaults using DIP switches, it's also possible to change several features using the front panel with the machine in set-up mode. You can toggle through the setting for nine different printer options, including 10 or 12 characters per inch, slashed zero, and proportional or condensed type. Unfortunately, since the printer has neither an LCD screen nor any type of menu system, the only signal you have to go by is a single tone that sounds each time you toggle to a new setting. If you lose count of which feature you're up to, you'll have to begin the process all over again.

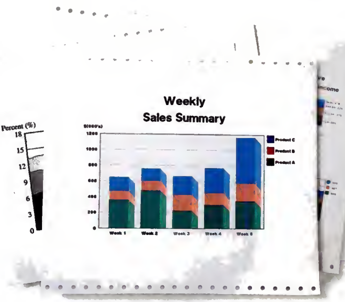
The printer's control panel is located to the left of a wide front opening that admits cut-sheet paper. This system lets you use cut sheets while the printer is loaded with fanfold paper. You have to place the sheets directly on top of the fanfold (a process that predates the more efficient paper parking feature that many current printers include). Loading fanfold paper is also a bit different with the Proprinter: you feed paper under the platen by hitting the form-feed button, watching the tractors revolve in slow motion (making a sound like teeth grinding), and trying to fit the holes in your fanfold paper to the moving pins. Once the paper catches and is drawn under the platen, you're set.

The Proprinter offers two resident NLQ

PC FACT FILE

IBM Proprinter II XL
IBM Corp.
Contact your local authorized IBM dealer.
(800) 447-4700
List Price: $799
Dimensions (HWD): 5.25 x 22 x 14.5 in.
Weight: 24 lbs.
Emulations: IBM Proprinter
In Short: This version of the 9-pin IBM Proprinter delivers exactly what it promises: good-quality type at a solid pace. Yet some of its features, such as an uninformative front panel and cut sheets that feed in over the fanfold paper, are now a bit old-fashioned.

CIRCLE **622** ON READER SERVICE CARD



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And Graphwriter II offers you 24 different graph types—more than any other PC graphics package. So you can choose the chart type that best represents your data.

What's more, you have control over hundreds of style settings such as type font, heading location, bar width and color.

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Lotus Graphwriter II

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Lotus Graphwriter II

*Graphwriter II demonstration kit requires an IBM® PC or compatible, 256k and a graphics card.

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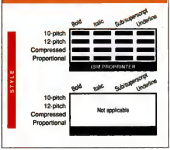
CIRCLE 530 ON READER SERVICE CARD

types. NLQ1, the default, is a straightforward sans serif font that is nice and sharp, especially for a 9-pin printer. NLQ2 is another sans serif, but just a bit more rounded. There is also a "Fastfont" to use when you're in a hurry; its print is as readable as the usual draft mode (the old connect-the-dots type), but the letters are just close enough to touch. And it does speed the already well-paced Proprinter up to 153.6 characters per second.

Although the Proprinter II XL can't be called exciting, it certainly delivers what it promises: reasonably sharp, reasonably fast printing.—**Barbara Krasnoff**

IBM Proprinter III and III XL



It must be tough to come up with improvements on a design that most people already praise. IBM's newest Proprinter models, the $649 Proprinter III and the $899 Proprinter III XL, have arrived with another load of features and functions to please users and frustrate would-be competitors.

The Proprinter III models are 9-pin dot matrix printers. The XL version has a wider carriage and can feed paper up to 16½ inches wide. Both printers have internal push tractor-feeds and friction-feed capability as well. The original Proprinter was the first dot matrix printer that let you print on single sheets without removing the fanfold paper already loaded—although the fanfold paper fed through as well.

From that waste came the concept of paper parking, whereby paper loaded in the tractors could be retracted and kept out of the way for single-sheet or envelope feeding. The newest Proprinters have made paper parking controllable through one button on the front panel.

FACT FILE

IBM Proprinter III and III XL
IBM Corp.
Contact your local authorized IBM dealer.
(800) 447-4700
List Price: Proprinter III, $649; Proprinter III XL, $899.
Dimensions (HWD): Proprinter III, 5.5 x 16 x 14 in.; Proprinter III XL, 5.5 x 24 x 14 in.
Weight: Proprinter III, 19.2 lbs.; Proprinter III XL, 24 lbs.
Emulations: IBM Proprinter
In Short: The Proprinter III and III XL are the latest in IBM's winning series of 9-pin entry-level printers. The newest versions are faster than the previous models and include more features and easier operation. While these printers may not be terribly exciting compared with more-expensive or more-esoteric models, they are dependable and easy to operate.
CIRCLE **668** ON READER SERVICE CARD

Speed has also been improved. IBM has souped up both Proprinters, and the wide-carriage XL model really hauls. At 10 characters per inch in our wide-printing test, the III XL attained speeds of 204.8 characters per second in draft mode, 234.9 cps in high-speed-draft mode, and 57 cps in near-letter-quality mode. Many machines marketed to compete with the Proprinters attain speeds only of about 175 cps. Now they have to go back to their engineers once more.

Other improvements in the new Proprinters include an optional sheet-feeder ($199 for the III and $249 for the III XL), a mechanical paper-tear-assist bar, the addition of an italic font, and software-controlled DIP switches.

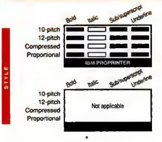
The standard interface port is Centronics parallel, though if you really want it, a serial port is a $119 option. These printers don't bother emulating anything but other Proprinters, which makes sense. Standard fonts include a default NLQ font, NLQ sans serif, or NLQ italic. All fonts are available in 10, 12, 17.1, and 20 cpi, and proportional pitch.

The control panel uses buttons, lights, and tones to control paper movement and parking, NLQ or draft mode, fonts, pitch, print modes, and on/off-line status. You choose many of the options by pushing the Propark button a specific number of times. (Did you know that the musical beeps created by the Proprinter come not from a chip but from playing the wires in the printhead?)

IBM is so confident about these products that it sells a 1-year on-site service contract for $49 for the III and $75 for the III XL. Since other on-site contracts for a year often cost up to 20 percent of a product's original retail price, these sub–10 percent prices are impressive. You can save even more by buying carry-in contracts at $38 and $60, respectively.

These newest Proprinter models deliver fine print at a rapid rate with true ease of use and a good track record for reliability. Only the $499 Okidata Microline 320 offers a better price for comparable performance.—**Bruce Brown**

IBM Quickwriter



Usually, the IBM marketing and technical support people are straightforward and businesslike; they aren't the type to emote over products. When I talked with several IBM people about the Quickwriter, however, I sensed a different level of involvement. They like this printer a lot.

The Quickwriter is a 24-pin printer built to run forever, very quickly. It stakes its greatest claim to fame in the speed at which it prints near-letter-quality type. While 221.9 characters per second with 10 characters per inch in our wide-print test is very good indeed for a 24-pin printer, the 80.7-cps performance in NLQ mode is even better, especially for a printer that costs a mere $1,699. Faster 24-pin printers exist (the $2,195 Fujitsu DL5600, for example), but the Quickwriter costs hundreds less than most of them.

The Quickwriter also boasts a full family of options. Our evaluation unit came with several. The first box held the $849 multiple-bin cut-sheet and envelope feeder. Peering into the box was like looking into a dragon's maw, but IBM designed this obviously heavy-duty device to run without fail for a long time. A single-bin sheet-feeder is also available for $349, and an external tractor costs $129. No internal tractor is standard.

PC MAGAZINE EDITOR'S CHOICE

FACT FILE

IBM Quickwriter
IBM Corp.
Consult your local authorized IBM dealer.
(800) 447-4700
List Price: $1,699
Dimensions (HWD): 6.5 x 21.5 x 13.5 in.
Weight: 27.5 lbs.
Emulations: IBM Proprinter, Quietwriter III
In Short: IBM's high-end 24-pin dot matrix printer is very fast, delivers beautiful print, and has a line of optional paper-handling devices and fonts that can't be beat.

CIRCLE 660 ON READER SERVICE CARD

The Quickwriter's second category of options consists of font cartridges and software. A $125 EEPROM (electronically erasable programmable read-only memory) cartridge can be used to hold one or more fonts in memory. A disk with 29 fonts costs $50. You can download up to four fonts on one cartridge, and they will stay in ROM indefinitely. If you decide to use different fonts, you can replace the ones loaded onto the cartridge. This is a clever, hi-tech solution to font selection and printer memory requirements. There are also 18 fixed-font cartridges, each of which holds four fonts and costs $85.

The Quickwriter's print, with either film or fabric ribbon, is just gorgeous.

The Quickwriter has 8K RAM standard, with a 32K printer buffer option for $75. Both parallel and serial ports are standard.

The Quickwriter has four resident NLQ fonts, each available in different codes for the machine's two emulations—IBM Proprinter and IBM Quietwriter III. The NLQ fonts include Courier, Gothic, boldface proportional, and sans serif. Draft mode, also standard, isn't considered a font, but it's there.

The print, with either film or fabric ribbon, just has to be seen. It's gorgeous. If you think you need better, you should check again just to be sure. No, it's not laser quality, nor is it full-character printing as with a daisy wheel printer, but it will certainly meet most needs.

The only drawback to the Quickwriter is the price. You'll want to add at least the tractor feed and the 32K buffer. That puts the delivered price at just over $1,900. Those who actually need this much printer will probably opt for one or both of the sheet-feeder options as well, along with some font cartridges. You can easily spend well over $3,000 on this printer, but the machine is worth every penny.

The Quickwriter pumps out beautiful print impressively. With this model, IBM has hit on a winner for volume quality printing. Put the sheet-feeder on top of your Quickwriter, let it pound out a series of letters and envelopes, and you can easily see why those IBM reps were laughing.—**Bruce Brown**

Infoscribe Model 1100

STYLE

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	■	□	■	■
Compressed	■	□	■	■
Proportional	□	□	□	□

EPSON MX

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	■	□	■	■
Compressed	■	□	■	■
Proportional	■	□	■	■

DIABLO 630

The day I tested the Infoscribe Model 1100 will go down in history as The Day of the Great DIP Switch Disaster. While such format-control settings as lines per inch and near-letter-quality are set by a switch that resides comfortably under the front cover, if you want to set emulation or decide between the standard dual parallel/serial interfaces, it is your fate to fish around on the main circuit board, hoping that the switch will make itself apparent and you won't get electrocuted in the process.

If you are technically inclined and are looking for a machine that can run in environments as diverse as ships and factories for 24 hours a day, the 9-pin Model 1100 might be satisfactory.

The heavy, padded lid must be lifted both to feed in fanfold paper and to adjust the format-control DIP switches. In a crowded office, this may be a problem, as the lid is large and bulky. Paper is fed in through a slot on the front of the machine, up over the platen, across tractors, and out the back. Several times during testing, especially during tests that involved multiple sheets of paper, the paper came off of the

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Acoustic Noise	55 dBA	
Interfaces	Centronics Parallel or RS232C Serial	
Emulations	IBM® Proprinter XL,® IBM Graphics Printer,® Diablo 630® API, Epson JX80® (with Color Option)	
Color Option	User Installable Kit	

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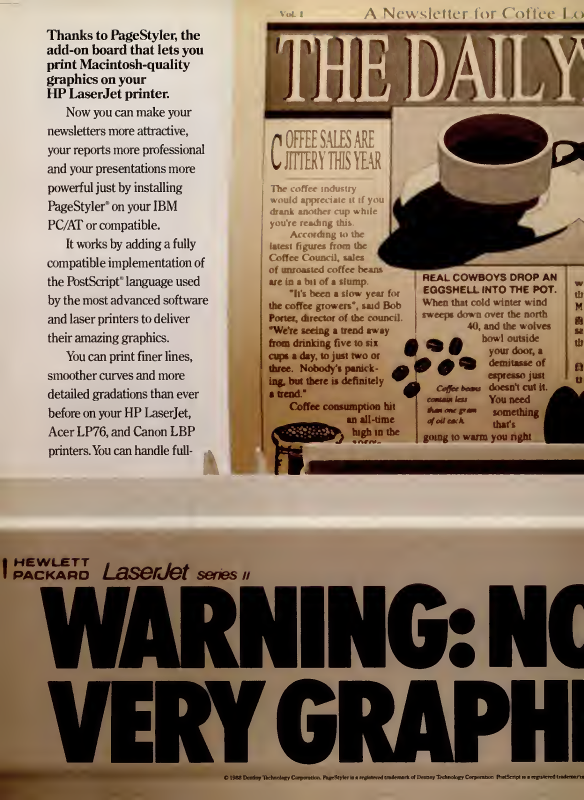
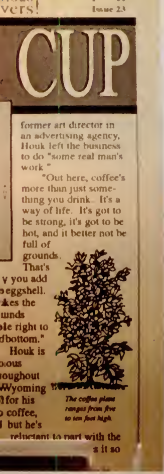
CIRCLE 503 ON READER SERVICE CARD



HEWLETT PACKARD LaserJet series II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CUP

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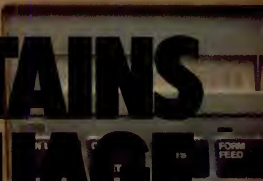

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FACT FILE

Infoscribe Model 1100
Infoscribe
Division of Eurotherm Corp.
11507 Sunset Hills Rd.
Reston, VA 22090
(703) 689-2805
List Price: $1,590
Dimensions (HWD): 7.2 x 25.5 x 15.2 in.
Weight: 32 lbs.
Emulations: Diablo 630; Epson MX; IBM 5152 Graphics Printer
In Short: A heavy-duty 9-pin printer designed to work under stressful duty cycles. Emulation problems and a complex procedure for setting DIP switches do not make this a likely companion for the average office PC.
CIRCLE **680** ON READER SERVICE CARD

tractors—not a good beginning for a machine that is sold to run continuously.

The Model 1100 does not come standard with graphics capabilities, but you can add ROM chips that offer such capabilities for no extra charge. I found these relatively easy to install, although again the back panel of the machine must be pulled out. For an additional $80 you can also get a bar code generator with four built-in bar codes.

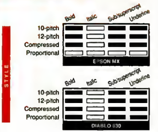
The printer's manual claims emulation for the Diablo 630, the IBM 5152 Graphics Printer, and the Epson MX, as well as the company's own Infoscribe mode. Although I was unable to test the 5152 and MX text emulations, I did run through the Diablo 630 test. In this mode, print style—near-letter-quality, correspondence quality, and draft—is set by DIP switches, and proportional and sub/superscript fonts by Escape codes. Bold and underlining failed, however, suggesting that the printer is partially Diablo 630 compatible. Since underlining is impossible to program through Escape codes or DIP switches in any mode, the printer makes two passes over a line you want underlined.

The Model 1100 chugs along at 102 characters per second in draft mode, an average performance at best for the $1,590 price tag. NLQ was slow at 36 cps, as was the graphics performance in Epson MX mode at 248 seconds—although the latter may be excused somewhat on the grounds that this printer was not originally designed to print graphics. Overall I found the print quality mediocre.

I wouldn't recommend the Model 1100 to anyone who is interested only in a single-user or single-office PC printer. The setup hassles, poor emulation abilities, and average print quality, combined with a high price tag, will make most users look elsewhere. But if your needs include forms processing in draft mode, the Model 1100 may warrant a closer look.

—Gretchen Luchsinger

Infoscribe Model 1400



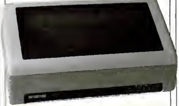
	Bold	Italic	Sub/superscript	Underline
10-pitch	■	☐	■	■
12-pitch	■	☐	■	■
Compressed	■	☐	■	■
Proportional	☐	☐	☐	☐

EPSON MX

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	☐	■	■
12-pitch	■	☐	■	■
Compressed	■	☐	■	■
Proportional	■	☐	■	■

DIABLO 630

FACT FILE



Infoscribe Model 1400
Infoscribe
Division of Eurotherm Corp.
11507 Sunset Hills Rd.
Reston, VA 22090
(703) 689-2805
List Price: $1,845
Dimensions (HWD): 7.2 x 25.5 x 15.2 in.
Weight: 32 lbs.
Emulations: Diablo 630; Epson MX; IBM 5152 Graphics Printer
In Short: Despite such options as a cut-sheet feeder tray and an NLQ mode, this heavy-duty 18-pin printer is a model best used for departmental forms processing.
CIRCLE **679** ON READER SERVICE CARD

Thinking of hauling your PC out to an oil rig? Need a printer that can keep on printing at temperatures from 32 to 122 degrees Fahrenheit? The 18-pin Infoscribe Model 1400 is designed to stand up to everything except immersion. In situations that include heavy-duty cycles and 24-hours-a-day forms processing, with an occasional internal memo, the Model 1400 fits the ticket.

The Model 1400 comes in a heavy metal case with a thick padded cover that almost shuts out the loud rattle of the printhead moving across the metal platen bar—not a problem in a factory but possibly something to consider in a quiet office. Paper feeds up from a front or bottom slot, across an internal pin system, and out the back of the printer.

Once you get the paper in, you are faced with setting three, four, or five DIP switches, depending on whether you choose to use the parallel or serial port in the dual interface board. Three switches along the back—one for the parallel and two for the serial port—change the interface settings. Two switches on the right front side of the printer under the cover set format and print mode choices. The location of the latter is a significant improvement over the Model 1100 (also reviewed in this issue), which has the print mode switch on the main circuit board.

The Model 1400 emulates three standards—the IBM 5152 Graphics Printer, the Epson MX, and the Diablo 630—and also has the resident Infoscribe mode. The printer failed our test on bold and underlining in the Diablo mode. Underlining is available only by making two passes on the same line. The IBM Graphics/Epson MX emulations passed the graphics test but could not be tested as text. The printer is not compatible with high-order IBM characters.

The Model 1400 is a wide-carriage printer, accommodating a maximum paper width of 16 inches. The printer is designed to handle multipart forms with up to six layers, although according to the company, airline tickets with nine parts are being processed on the machine. A maximum paper-weight number was not available.

A bar code option is available in the form of two EPROMs plugged into the main board. Bar codes can be created, or you can choose one of the 14 resident bar codes. This option costs an additional $80.

The Model 1400 is fast: it yielded an average of 200 characters per second in draft mode and 64 cps in near-letter-quality. But on today's market, at close to $2,000, the printer would be more competitive if the figure were over 250 cps.

If the oil rig is still calling, or if you want a reasonably friendly printer built for a department's forms-processing needs with a few of the features PC users have gotten used to, the Model 1400 is a cost-effective option.—**Gretchen Luchsinger**

Mannesmann Tally 222

STYLE

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

EPSON LQ

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	■	□	■	■
Compressed	■	□	■	■
Proportional	■	□	■	■

IBM PROPRINTER

At $899, the 222 is Mannesmann Tally's entry in the lower-priced 24-pin, wide-carriage market. While it does produce good-looking print, the machine is slow and relatively weak in font features.

PC MAGAZINE FACT FILE

Mannesmann Tally 222
Mannesmann Tally Corp.
8301 S. 180th St.
Kent, WA 98031
(206) 251-5500
List Price: $899
Dimensions (HWD): 5.5 x 23.5 x 15.5 in.
Weight: 24.2 lbs.
Emulations: Epson LQ-1500; IBM Proprinter XL
In Short: This 24-pin wide-carriage printer has two emulations and produces fine-looking print, but it is too slow and does not offer enough standard fonts to be competitive.

CIRCLE **659** ON READER SERVICE CARD

The 222 is a good-looking printer, and at 23½ by 15½ inches, it doesn't take up a lot of room. Installing paper and ribbons is straightforward, with the help of the semi-automatic single-sheet feeder and the internal push tractor. A single-bin 150-sheet sheet-feeder is a $199 option. Paper feeds from the rear, and both parallel and serial ports come standard.

A $9 color option (not included with the evaluation unit) works with four-color ribbons or, if you use a special 1-inch black ribbon, allows printing a full 10 million characters—four times the usual number—before you change ribbons. Since the standard ¼-inch ribbon costs $9.50 and the 1-inch ribbon only $14, the color option can pay for itself pretty quickly, even if you never use it for color output.

Saving pennies or dollars on ribbons doesn't make up for the 222's slow speed, however. In draft mode at 10 characters per inch, the fastest tested speed for wide text was 102.4 characters per second in Epson LQ-1500 emulation. In IBM Proprinter XL mode, the speed dropped to 60.5 cps. While the Epson emulation speed isn't very good, the IBM emulation speed is terrible. Letter quality 10-pitch print was clocked at 52.5 cps and 43.4 cps respectively, again in wide mode. The narrow mode tests were slower yet.

The graphics speed test results were even worse. In Epson LQ-1500 mode the test took 611 seconds—a little over 10 minutes—and in Proprinter emulation it took 574 seconds. These results stayed consistent over several tries, so the conclusion is obvious: don't buy this printer if you are going to print graphics very often, unless you have a huge printer buffer. The printer itself has an 8K buffer with no expansion options currently available.

This printer comes from a well-known and respected manufacturer. Its two standard emulation modes are reasonable choices. The only fonts resident are draft and near-letter-quality. You can buy optional emulation interfaces and font cards, but more fonts should come standard if the printer is to be truly competitive in this crowded market. That addition, along with a serious improvement in speed, would make the 222 a contender.—**Bruce Brown**

Mannesmann Tally 230/24

STYLE

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

EPSON LQ

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	■	□	■	■
Compressed	■	□	■	■
Proportional	■	□	■	■

IBM PROPRINTER

According to the Mannesmann Tally printer selection chart, the 230/24 is for word processing applications with a workload of 2,000 to 5,000 pages per month. The recommendation is surprising because the 230/24 is a dot matrix printer, but it's not far off.

As the name suggests, the 230/24 uses a

PC MAGAZINE FACT FILE

Mannesmann Tally 230/24
Mannesmann Tally Corp.
8301 S. 180th St.
Kent, WA 98031
(206) 251-5500
List Price: $1,499
Dimensions (HWD): 5.75 x 23.5 x 13.6 in.
Weight: 30 lbs.
Emulations: Diablo 630; Epson LQ-2500; IBM Proprinter, IBM 5152 Graphics Printer
In Short: This 24-pin, wide-carriage printer offers output with close to true letter quality (though not Selectric quality), along with good paper handling and crisp, dark graphics.

24-pin printhead. The company says that the 24 by 24 matrix of the near-letter-quality mode is equivalent to anyone else's 24 by 36 matrix because of a larger-than-usual pin size. Indeed, the NLQ mode is equivalent to the highest quality on many dot matrix printers—what some would call correspondence quality.

For its LQ mode, the 230/24 uses a matrix of 24 by 48, which Mannesmann Tally calls true letter quality. If you think of letter quality as synonymous with IBM Selectric quality, you will disagree. Yet the characters are solid and well formed, and you may well consider the output to be good enough for word processing—particularly if you want to use the LQ proportional space font.

Measured print speed on 8½-inch paper varies from 57.5 characters per second for LQ mode or 62.8 cps for LQ proportional to 71.9 cps for NLQ mode. This compares with about 60 cps for the fastest daisy wheel printers. Draft quality fares better, at 107.9 cps. For wide-carriage paper, speeds are only somewhat higher for the LQ modes: 63.9 cps for LQ and 72.6 cps for LQ proportional. They are notably higher for NLQ mode, at 103.7 cps, and dramatically so for draft mode, at 190.2 cps. Alas, draft quality may be hard on the eyes: you can see the individual dots that make up the characters.

Graphics on the 230/24 are crisp and dark. More important, the printer produces the details of intricate patterns. Timing for the graphics speed test was about 245 seconds in Proprinter mode and about 330 seconds in Epson LQ-2500 mode. And it's worth noting that even in graphics mode, the 230/24 is unusually quiet for a dot matrix printer, making it a comfortable office companion.

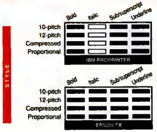
Emulations include the IBM Proprinter and Graphics Printer, the Epson LQ-2500, and the Diablo 630. In each of these emulations the printer will also respond to ANSI control sequences, so you can take advantage of features that aren't found in the printer being emulated. On the PC Labs text emulation tests and high-order character test, the printer performed without problems.

The printer's paper handling is also worth comment. The built-in tractor functions as either a push tractor for rear feed or a pull tractor for bottom feed. Even better are such extras as the quick-tear feature, which advances the paper just enough to let you tear off a sheet, then moves it back for printing on the next sheet. The printer can also roll tractor-fed paper out of the way to print single sheets or envelopes, then automatically roll it to the correct position for printing.

The MT 230/24's graphics are crisp and dark, and the printer produces details of intricate patterns.

Alas, at $1,499, the MT 230/24 is not something to get excited over, but if your budget won't stretch to laser price range and you want a reasonably quiet printer with better-than-average print quality, the machine is worthy of your investigation.
—M. David Stone

Mannesmann Tally 340



STYLE

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	■	□	■	■
Compressed	■	□	■	■
Proportional	■	□	■	■

IBM PROPRINTER

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

EPSON FX

Mannesmann Tally's German-born printers have tended to be larger, faster, and more expensive than the Japanese-built models that the company also sells. The 340 definitely fits the German mold.

The 340 is an 18-pin, wide-carriage dot matrix printer. With a list price of $2,278, a weight of 55 pounds, and a tested speed of 190.2 characters per second in 10-character-per-inch wide-carriage mode, this machine needs something extra to be price-competitive. The edge here is ruggedness. The 340 is built from big, heavy components that give the impression they will keep on working for a long time without breaking or bending.

Even the Styrofoam shipping pieces are sturdy. There's no trick to setting up this printer; if you do have questions, the manual is reasonably helpful. A parallel interface comes standard, with a serial port optional.

In draft mode the 340 achieves speeds of 150.0 cps at the narrow setting and 190.2 cps at the wide setting. Those speeds are acceptable, though nothing to crow about. It's the near-letter-quality speeds of 123.3 cps (narrow) and 137.7 cps (wide) that are most impressive. Interestingly enough, the printer reaches these high speeds only in Epson FX emulation mode. You get only about half the performance in

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CIRCLE 537 ON READER SERVICE CARD

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CIRCLE 328 ON READER SERVICE CARD

the other text emulation, the IBM Proprinter setting.

The only fonts that come standard are draft and NLQ type, although four font cards are available at $79 each.

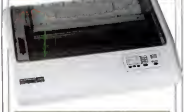
The 340 comes with a rugged internal tractor feed, though it's a fair bet that many users of this type of machine will opt for the $499 dual-bin sheet-feeder with a 125-sheet capacity in each bin.

The printer's menu system is complete but archaic in design. You access a system of hierarchical outline-style function and setting menus by using the printhead to type information and change options, positioning the head over the desired choice. This method sounds convenient, and it isn't necessarily a bad idea. Some other manufacturers use similar systems, but the Mannesmann Tally version is irritating.

First of all, to see what's going on with the menu system, you have to open the front of the printer. Then, in order to change anything, you have to work your way through all previous settings on the menu. There's no way to choose a particular function without other steps. If you don't change settings often, this system isn't much of a problem, but in testing we try all or most settings, and this quickly became a chore.

The 340 is best suited for heavy use in an office where large quantities of fine-quality type are needed. The machine is too expensive for single users, but its high speed and type quality make it a contender and outweigh the inconvenience of changing settings.—**Bruce Brown**

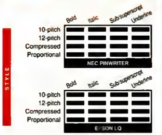
FACT FILE



Mannesmann Tally 340
Mannesmann Tally Corp.
8301 S. 180th St.
Kent, WA 98031
(206) 251-5500
List Price: $2,278
Dimensions (HWD): 6.5 x 24 x 22.5 in.
Weight: 55 lbs.
Emulations: Epson FX; IBM Proprinter, 5152 Graphics Printer
In Short: The 18-pin 340 is ruggedly built and very fast, and it produces nice print, although at a high price. Its awkward menu structure is irritating to work with but probably not a factor if you don't change printer settings often.

CIRCLE 658 ON READER SERVICE CARD

NEC Pinwriter 2200



The success of the desktop 9-pin dot matrix printer has depended in large part on people who weren't willing to pay the high prices associated with 24-pin printers, despite the significant difference in the quality of output. A slew of cheaper 24-pin machines introduced this year may put a dent in the 9-pin market. This is one example: at $569, the Pinwriter 2200 would probably be my choice if I had to go out and buy one tomorrow.

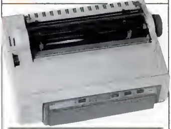
The 2200 impressed me from the moment I walked in and saw it perched unobtrusively on the test bench. The 11-pound weight spec may sound suspicious, but the printer is one of those rare birds: light and well made. The plastic top covers snap firmly into place. I did have some problems with the manual feed knob; it frequently slipped off in my hand. The company claims a mean time between failures (MTBF) of 4,000 hours.

The 2200's paper-handling capabilities are sophisticated for a machine in this price range. Although I ran only fanfold and cut-sheet paper through the machine, NEC reports that envelopes and tractor-fed labels are also acceptable. You can load cut sheets and continuous forms through a front slot, over the platen, and, in the case of continuous forms, across an internal pin mechanism. An optional sheet feeder ($149) holds 50 sheets.

The documentation claims that the 2200 emulates the Epson LQ series of printers, including the LQ-1500 and the LQ-2500. The graphics emulation went through without a hitch. In the fonts and features emulation test, which was set on the LQ-1500, the 2200 failed to print the preprogrammed sans serif font. This suggests either that the 2200 is not 100 percent LQ compatible or that it is compatible with the higher-end LQ-2500. Two sans serif fonts—Super Focus and OCR-B—are available in the printer's LQ mode through an Esc code sequence or through a memory mode menu generated from the front control panel.

The 2200 operates at three speeds: letter

FACT FILE



NEC Pinwriter 2200
NEC Information Systems Inc.
1414 Massachusetts Ave.
Boxborough, MA 01719
(617) 264-8000
List Price: $569
Dimensions (HWD): 4.8 x 14.8 x 10.8 in.
Weight: 11 lbs.
Emulations: Epson LQ-2500
In Short: With a lot of bang for the buck, the Pinwriter 2200 is an inexpensive 24-pin printer offering a slow but excellent LQ mode.

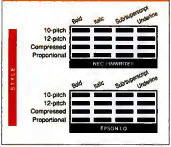
CIRCLE 677 ON READER SERVICE CARD

quality, draft, and 12-character-per-inch high-speed draft. The letter quality is not the speediest around, at 30.3 characters per second, but the quality of the print is such that only a close inspection reveals its dot matrix origins. Draft and high-speed draft are less thrilling. Print quality in HSD is so poor—with squashed dotty characters that look wider than they are high—that you will probably use it once and abandon it. Draft isn't as bad, and the speed, at 51.5 cps, isn't different enough from HSD's 82.2 cps to be significant. Proportional type runs only in letter quality mode.

The NEC 2200 is slow. It uses a fabric ribbon, where many 24-pin printers use higher-performance multistrike mylar ribbons. But for sophisticated paper handling and a decent selection of resident fonts, as well as the option of adding cartridges, plus a footprint and weight that keep this printer in the range of two large notebooks, the NEC 2200 may well be the deal of this year's 24-pin dot matrix printer market.

—Gretchen Luchsinger

NEC Pinwriter 5200



EDITOR'S CHOICE

PC MAGAZINE FACT FILE

NEC Pinwriter 5200
NEC Information Systems Inc.
1414 Massachusetts Ave.
Boxborough, MA 01719
(617) 264-8000
List Price: $799
Dimensions (HWD): 5.8 x 16.8 x 15.3 in.
Weight: 20 lbs.
Emulations: Epson LQ-2500
In Short: A 24-pin dot matrix printer that uses both multistrike and fabric ribbons. Although the Pinwriter 5200 is a more sophisticated and expensive version of the company's 2200, the less-impressive print output may not warrant spending an extra $250.
CIRCLE 678 ON READER SERVICE CARD

Built as successors to the NEC Pinwriters P6 and P7, the Pinwriters 5200 and 5300 (the wide-carriage version was not tested here) represent NEC's latest foray into midrange 24-pin printers, a market that has traditionally been the company's strongpoint. Since the 24-pin market is becoming increasingly crowded, you have to decide what features you want most. In this case the features include a huge 80K input buffer, a wide choice of fonts, decent speed, and a mean-time-between-failure rate of 6,000 hours.

The 5200, which costs $799, is a boxy machine with a footprint that guarantees it will take up a good hunk of wherever you choose to put it. Paper loads into the printer from the back or the top. Once the paper is attached to the tractors or positioned on the sheet guard insertion slot, you press the select button to put the printer off-line.

A copy-control lever is located on the top left side of the 5200 to adjust the printer for different paper thicknesses—with a multipart-forms thickness of one original and up to three copies. A control panel along the front of the machine allows you to select pitch, type style, quiet mode, feed, and select to take the printer off-line. All resident fonts can be selected from the type style button, with LEDs indicating which font has been chosen. The choices include ITC Souvenir, Bold Proportional, Times, Helvette, and Font Card. The last is available in eight different flavors for $125. Up to four fonts can be included on one card.

The feed button serves for both line feed and form feed. Unfortunately, this button presents an either-or situation. Either you press the button down and feed the entire form, or you jab at it repeatedly to advance line by line.

Three ribbons are available with the 5200: fabric, multistrike mylar, and a four-color ribbon ($14, $12.50, and $25, respectively). Although the multistrike ribbon is supposed to come standard with the machine, we were sent the fabric ribbon. Print quality in the letter quality Courier mode is excellent, although not as impressive in terms of bang for the buck as the output of the less-expensive NEC 2200. The 5200's output is faster, however, with 138 characters per second in draft and 49.3 cps in LQ. High-speed draft, available only in 12 pitch, will make your eyes cross; at 150 cps, it is not fast enough to become a feature you'll depend on.

The NEC 5200 is supposed to be Epson LQ compatible. Testing the printer with our test program set on Epson LQ-1500 produced some discrepancies that indicate the printer fully emulates only the Epson LQ-2500. This should not pose a problem, as most PC programs support both.

> *With enough font options for desktop publishing, the NEC 5200 belongs to the world of the small business, individual office, or home running professional applications.*

The NEC 5200 belongs to the world of the small business, individual office, or home running professional applications. The number of font options makes desktop publishing output possible; the speed of

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CIRCLE 354 ON READER SERVICE CARD

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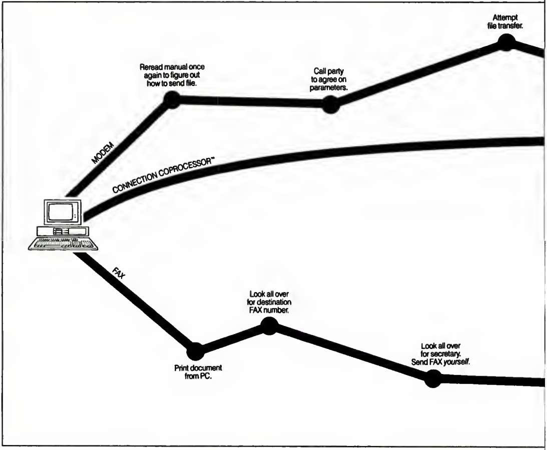
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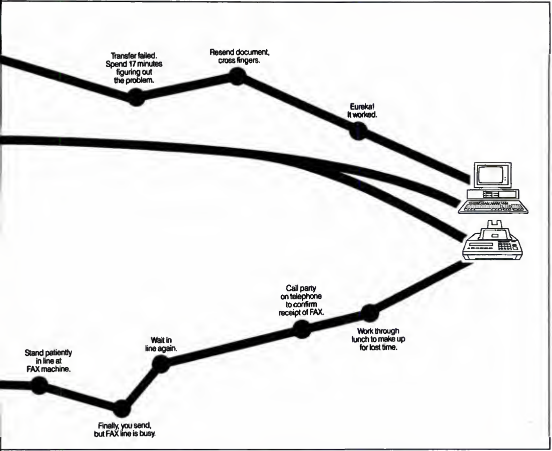
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CIRCLE 297 ON READER SERVICE CARD

the draft mode is a plus in spreadsheets and possibly accounting packages, and the LQ font is respectable enough to go beyond the inner office.—**Gretchen Luchsinger**

Okidata Microline 320 and 321

STYLE

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	☐	■	■
12-pitch	■	☐	■	■
Compressed	■	☐	■	■
Proportional	■	☐	■	■

IBM PROPRINTER

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

EPSON FX

Running the new 9-pin Okidata Microline 320 and 321 printers is something like driving a big, sturdy Oldsmobile sedan. In true Okidata fashion, $499 (or $699 for the wide-carriage 321) nets you a box loaded with thick plastic covers and heavy-duty controls. It seems these printers are built to outlast every other printer on the planet.

The machines' footprints are a little larger than other low-end dot matrix printers on the market. And the prices are higher than normal. But oh, what a relief to find a printhead that doesn't feel as if it's about to wobble off—and sound covers that actually do snap into place and don't interfere with paper feed!

One noteworthy characteristic is that the phrase "DIP switch" is never mentioned in the well-written, well-illustrated reference manual. Okidata has chosen to replace the DIP switches with a membrane "mode" button on the front panel. Three other buttons act alternatively as line feed/group, form feed/item, park/set, and TOF/print. The mode button gets you into the second set. If you press print, the 320/321 prints out a list of current settings, including font, emulation, character set, and line spacing.

The 320/321 also sports paper park. Fanfold paper can be fed in from the back of the printer to an inconveniently located internal pin system—one of the few negative aspects of the design. The paper automatically feeds in around the platen to the printhead when you pull the bail lever forward. An optional pull tractor for $49 (320) or $59 (321) gives you bottom feed for types of paper that are difficult to wrap around the platen.

The printers offer both Epson FX and IBM Proprinter emulations. In our graphics speed test, the Epson FX emulation was notably speedier than the IBM. For both printers, the average speed for a one-page graphic printout in Epson mode was about 66 seconds, compared with 184 seconds for the IBM. Text print speed was high: both models produce a high-speed draft mode clocked at 164 characters per second. Near-letter-quality was a decent 61 cps.

Print quality, in NLQ mode, is clean and crisp enough for your average memo. And draft mode is easy on the eyes, with ruler-straight lines and even characters.

The only major difficulty I had with these printers was the sound. Our tests measured the 320 at 74 dB and the 321 at 72 dB—both in the average range. While there was nothing appreciably abnormal about the 320, the 321 was a dead ringer for a dentist's drill.

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

Okidata Microline 320 and 321
Okidata
532 Fellowship Rd.
Mount Laurel, NJ 08054
(800) OKI-DATA
(609) 235-2600
List Price: Microline 320, $499; 321, $699.
Dimensions: Microline 320, 4.6 x 15.7 x 16.1 in.; 321, 4.6 x 21.7 x 17 in.
Weight: Microline 320, 16 lbs.; 321, 20 lbs.
Emulations: Epson FX; IBM Proprinter
In Short: The new Microlines are durable 9-pin printers, with enough features packed in to justify a slightly larger size and higher cost.

CIRCLE **675** ON READER SERVICE CARD

Both the Microline 320 and the 321 are good choices in this year's new printer roundup. Durability and a decent array of features make either machine suitable for home users with heavy printing requirements or for individuals in offices who need something for the long haul.
—**Gretchen Luchsinger**

Okidata Microline 390 and 391

STYLE

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

EPSON LQ

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	☐	■	■
12-pitch	■	☐	■	■
Compressed	☐	☐	☐	☐
Proportional	■	☐	■	■

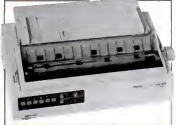
IBM PROPRINTER

The Microline 390 and 391 24-pin dot matrix printers, at $699 and $949, are Okidata's narrow- and wide-carriage answers for users who need both Epson LQ-1500 and IBM Proprinter compatibility. Both printers offer three emulations, one of which is compatible with the Proprinter AGM (Alternate Graphics Mode), plus six typefaces and a full-control front panel. They also come with a 23K buffer, half of which can be devoted to downloaded fonts. The best part is, you can access all of this power and flexibility easily.

Through the front control panel, you can set the emulation and default typeface and quality, as well as the top-of-form position and form and line feeds. The mode button allows you to access the secondary features of the control panel. By cycling through the group, item, and setting, you can change any of the default values. A complete printout of them is also available.

Built-in fonts are limited to Courier and

PC MAGAZINE FACT FILE



Okidata Microline 390 and 391
Okidata
532 Fellowship Rd.
Mount Laurel, NJ 08054
(800) OKI-DATA
(609) 235-2600
List Price: Microline 390, $699; 391, $949.
Dimensions (HWD): Model 390, 4.6 x 15.7 x 13.6 in.; Model 391, 4.6 x 21.7 x 13.6 in.
Weight: Microline 390, 18.5 lbs.; 391, 22.3 lbs.
Emulations: Epson LQ-1500; IBM Proprinter
In Short: The 24-pin Microlines 390 and 391 offer crisp and speedy text output in both Epson and IBM emulations at reasonable prices and with a friendly user interface.
CIRCLE **674** ON READER SERVICE CARD

Gothic. Each can be sized to seven different pitches and enhanced with italic, underline, and emphasis. A proportional near-letter-quality print is also available. You can buy optional fonts, either in the form of software or cards. The card-resident fonts are selected either through software or from the front panel.

You can feed paper through the top (for one-sheet manual paper feed) or from the rear (for automatic continuous-form paper feed). Both printers sport an internal tractor that pushes the paper through the path as well as parking it. This parking feature lets you insert and print on a single sheet without losing any of the continuous-form paper. Once you are finished printing the sheet, you can return to your normal forms for the next print job. An optional pull tractor that attaches to the top of the printer allows a bottom paper path.

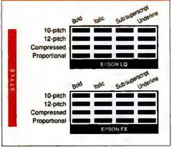
The quality of the print is excellent, with letters standing out crisp and sharp even in draft utility mode. In fact, the only time you see any deviation from a character's form is if you look very closely at an *s*, when you will notice only the slightest aliasing around the curves. Graphics quality, on the other hand, is less than perfect. In outputting one of PC Labs' graphics images, the printhead displayed a tendency to drag on the page just before it made its pass back to the left margin. The result was a distinct smudge.

While the Quiet feature noticeably dulls the staccato (testing shows a drop of about 5 dB), it also slows the print speed considerably. Letter quality, for example, drops to one-fourth its normal speed of approximately 68 characters per second, and quiet draft-quality speed is a little more than a fifth the rate of normal draft-quality speed (a little under 144 cps).

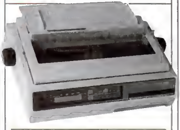
When the Microline series was first introduced some years back, I reviewed one model for *PC Magazine*. At that time, the printers were a sharp departure from the Sherman tanks of printerdom, the Okidata 80/90 series, and the first run of production models were far less than one would have expected from Okidata. These new Microlines, however, are definitely printers to admire, and you would have to go far to find a better all-purpose printer.

—Vincent Puglia

Okidata Microline 393C



PC MAGAZINE FACT FILE



Okidata Microline 393C
Okidata
532 Fellowship Rd.
Mount Laurel, NJ 08054
(800) OKI-DATA
(609) 235-2600
List Price: $1,499
Dimensions (HWD): 7.09 x 25.2 x 16.42 in.
Weight: 37 lbs.
Emulations: Epson LQ
In Short: The 24-pin Microline 393C is a superb four-color dot matrix for all but professional desktop-publishing jobs. Also available for $100 less is the black-ribbon-only Microline 393.
CIRCLE **673** ON READER SERVICE CARD

Color impact dot matrix printers have come a long way in recent years, and Okidata has built into the Microline 393C about all the versatility that any of us really need. At $1,499, the 393C comes with a built-in push tractor and both Centronics parallel and DB-25 serial interfaces. Up to four-part forms paper can be pressure or pin-fed, with a maximum 16-inch width and 24-pound weight. The Microline 393C supports the full IBM character set, including foreign-language and box-drawing characters. Okidata claims a speed rating of 120 to 450 characters per second, but our tests achieved a far more modest 80 to 200 cps.

The 393C extrudes paper when it stops, so you can tear off the last printed sheet without hitting form feed. When the printer restarts, the dangling sheet retracts again under the printhead, so paper isn't wasted. Protocols reside in personality cartridges that snap into place under the front panel. At this time the one available cartridge implements Epson LQ emulation, but more are promised.

The printer has only one resident typeface, Courier, but there is a font cartridge

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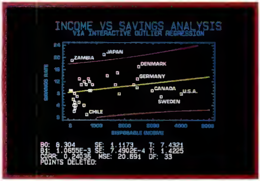

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B0:  8.304      SE:  1.1173     T:  7.4321
B1:  1.0655E-3  SE:  7.4902E-4  T:  1.4225
CORR:  0.24036  MSE:  20.691   DF:  33
POINTS DELETED:
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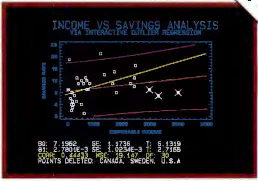
Select the points you want to remove from your regression model . . .


INCOME VS SAVINGS ANALYSIS
VIA INTERACTIVE OUTLIER REGRESSION
SAVINGS RATE
0
DISPOSABLE INCOME

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B0:  7.1962     SE:  1.1736     T:  6.1319
B1:  2.7801E-3  SE:  1.0234E-3  T:  2.7166
CORR:  0.44433  MSE:  19.147   DF:  30
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. . . Then press F6 to refit the model and recalculate the statistics.

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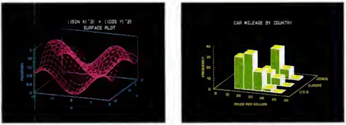

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CIRCLE 156 ON READER SERVICE CARD

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Traveling Software

CIRCLE 223 ON READER SERVICE CARD

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bay for your choice of Prestige or Gothic. Each typeface can appear in 10, 12, 15, 17.1, or 20 characters per inch. Depending on your use of font cartridges, you'll have between 8K and 30K of buffer space. You can also design your own downloadable characters, though you can't buy any from Okidata. Stylistic enhancements include bold, underline, italic, compressed or expanded type, and super/subscripting.

A well-designed front panel allows you to set many otherwise software-controlled options manually. There are separate LED indicators for power, alarm, quiet (that is, slow) and select (that is, ready), and membrane buttons for quiet, line feed, form feed, top of form, and select.

The 393C is effortless to set up. Its clear-plastic ribbon cartridge will satisfy the curiosity of those who always wonder how so much ribbon can squeeze into those tiny cartridges without bunching up. When turned on, the 393C comes alive. The 24-pin, belt-driven, bidirectional printhead shakes itself from side to side, the ribbon holder rises and falls, and the bail lever opens and shuts.

At power on, you can put the printer in Hex Dump mode to verify that it's getting the same data your computer sent, or you can activate an unusually lengthy self-test that prints samples of many combinations of pitches and styles in eight color combinations. You can also invoke an interactive firmware program in which current and alternate menu selections are printed for you on paper rather than displayed in the currently fashionable one-line LCD.

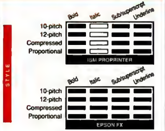
The 393C's protocols reside in personality cartridges that snap in under the front panel.

Optional add-ons for the 393C machine include the $49 font cartridges for either Prestige or Gothic typefaces, a $79 pull-tractor mechanism for greater registration precision, and a 170-page cut sheet feeder (single-bin $399, dual-bin $699).

The Microline 393C upholds Okidata's reputation for sharp output and offers the added bonus of color capability. If you like the specs but don't need color, take $100 off the list price and ask for the nearly identical Microline 393 instead.

—Dean Hannotte

Relisys RP1814



$225 is one of the lowest list prices around for a 9-pin dot matrix printer. True, concessions include a plastic case so light you'll wonder why it doesn't float away. But for the casual home user or the recent electric typewriter graduate, the Relisys RP1814 may prove to be a steal.

The RP1814 offers all the basic typefaces. Elite, pica, condensed, enlarged, and emphasized are selected from a front panel of LEDs, along with near-letter-quality and draft modes. The selection procedure takes some getting used to, as you have to take the printer off-line with the raised on-line button on the left of the control panel. The on-line switch must be pressed again in conjunction with the raised form-feed button and—with luck and nimble fingers—voilà! the first LED for NLQ/draft starts flashing. By repeatedly pressing the on-line button, you can page through the other print modes. Obvious cost-cutting appears on the scene here—the print-mode LEDs are arranged in two rows of three, no more than ¼ inch apart. Only a well-attuned eye can tell immediately which LED is flashing.

With both pressure feed and an internal pin system, the RP1814 can handle both cut-sheet and fanfold paper. Cut-sheet paper must be fed one sheet at a time in the absence of a feeder mechanism.

During our tests, print speed clocked in at a decent rate (for the money): 98.7 characters per second in draft and 28.1 cps in near-letter-quality. Print quality was another story. Remember the days of the manual typewriter when, if you drew a line along the base of a series of characters, not all of them would touch it? Characters are reasonably dark in NLQ mode, but the squashed *g*'s and *y*'s are enough to bring on a case of eyestrain.

One major stumbling block with the RP1814 involves compatibility. The printer includes IBM Proprinter and Teco emulation modes. Teco mode is similar to but not quite the same as standard Epson FX mode—in other words, similar to but not quite reality. Our graphics speed test, run under Epson FX emulation, gave a distended image. This may not prove a problem to the user who depends on the printer

PC MAGAZINE FACT FILE

Relisys RP1814
Relisys
320 S. Milpitas Blvd.
Milpitas, CA 95035
(800) 635-0999
(408) 945-1062
List Price: $225
Dimensions (HWD): 4.0 x 15.7 x 13.3 in.
Weight: 17.1 lbs.
Emulations: IBM Proprinter; Teco (similar to Epson FX)
In Short: This 9-pin printer—about as cheap as they come—would serve well for first-time users or those with low-end printing needs.

CIRCLE **672** ON READER SERVICE CARD

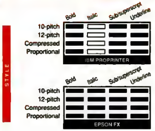
solely for word processing, but if you are interested in printing graphics, this nonstandard emulation may prompt you to look elsewhere. Emulation mode is controlled by a DIP switch located—clench your teeth—under the ribbon.

No additional fonts are available with the KP1814, but one option, an RS-232C serial interface, can be had for $50.

The RP1814 is a classic example of the low-performance, low-price, "made somewhere in Southeast Asia" printer. While such a machine could hardly fare well under duress in an office, this printer will fit comfortably in situations requiring infrequent and low-level usage.

—Gretchen Luchsinger

Relisys RP2410



STYLE

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	☐	■	■
12-pitch	■	☐	■	■
Compressed	■	☐	■	■
Proportional	■	☐	■	■

IBM PROPRINTER

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

EPSON FX

PC MAGAZINE FACT FILE

Relisys RP2410
Relisys
320 S. Milpitas Blvd.
Milpitas, CA 95035
(800) 635-0999
(408) 945-1062
List Price: $259
Dimensions (HWD): 4.5 x 16.5 x 17.2 in.
Weight: 17 lbs.
Emulations: IBM Proprinter; Teco
In Short: The RP2410 is a low-end 9-pin dot matrix printer. Unfortunately, its propensity for paper jams and ribbon catching makes it too low to consider.

CIRCLE **637** ON READER SERVICE CARD

The market for low-end dot matrix hardware continues to thrive. Many people who are just starting to work with computers want the least expensive printer that they can find. Also, organizations with shared laser printers and other fancier devices often want low-cost draft printers for every computer.

So while the competition rages among makers of sophisticated laser printers and rumbles among high-end, superfast dot matrix printers, a huge market exists for reliable, low-cost draft machines. The RP2410 is Relisys's shot at that market. Unfortunately, it's off the mark.

This 9-pin printer's speed and print quality, its Epson and IBM dot matrix printer compatibility, and its ease of programming are all just fine. However, the RP2410 has an archaic paper-handling mechanism. If the ribbon gets stuck in the printhead, you have to move three heavens and at least two hells before you manage to free it, in the meantime getting yourself covered with ink.

Once we figured out how to take the printer apart enough to liberate the ribbon, everything turned out just great, but beginners, casual users, and normally dressed office workers should keep their distance from this potentially messy printer.

The RP2410's nominal speed is 200 characters per second; however, it operates at an actual printing speed of slightly less than half that.

It has a built-in pin-feed mechanism that is supposed to push paper around the platen and then back. In practice the paper jammed much too often.

Setting up the RP2410 is relatively easy, helped by a slim user manual with clear illustrations. The printer does not have a serial port; the only interface is a parallel port located at the printer's rear. After you've removed the shipping inserts and restraints, loaded some paper, and put in the harmonica-style ribbon, the printer is ready to go. In order to switch between IBM and Teco (Epson-compatible) modes, you must remove the ribbon and set DIP switches located inside the printer in the front left corner.

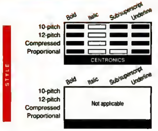
Six-print mode indicators—single LEDs—are located on the front of the machine. While off-line you can use buttons to select modes. The easily selectable modes include draft or near-letter-quality print, elite or pica type, condensed or normal type, and emphasize, italic, or enlarged print. Italic is available only in Teco (Epson) mode.

The RP2410 passed all IBM and Epson compatibility tests with ease, including printing the sometimes elusive high-order character set.

At $259, the RP2410 is sure to sell, but the machine's mediocre quality should make savvy shoppers look elsewhere.

—Bruce Brown

Relisys VP1821



STYLE

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	☐	■	■
12-pitch	■	☐	■	■
Compressed	■	☐	■	■
Proportional	■	☐	☐	■

CENTRONICS

	Bold	Italic	Sub/superscript	Underline
10-pitch	Not applicable			
12-pitch				
Compressed				
Proportional				

The Relisys VP1821 is another example of a product designed to satisfy the modern world's obsessive desire to have its cake and eat it, too. Is it possible to offer a 24-pin dot matrix printer with a variety of typefaces—as well as 13,053 Chinese characters for those who are interested—for under $600? The Relisys VP1821 proves that for $599 you can have your cake, but you may not relish the eating.

The VP1821 is a wide-carriage printer that allows a maximum paper width of 16

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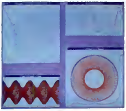

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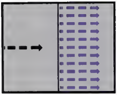

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PC MAGAZINE FACT FILE

Relisys VP1821
Relisys
320 S. Milpitas Blvd.
Milpitas, CA 95035
(800) 635-0999
(408) 945-1062
List Price: $599
Dimensions (HWD): 4.5 x 17.5 x 21 in.
Weight: 25 lbs.
Emulations: Centronics
In Short: The Relisys VP1821 proves that selling a quality 24-pin printer for less than $600 may be an impossible task. Poor graphics emulation and a freezing membrane-button control panel make this machine a less-than-safe bet.
CIRCLE **636** ON READER SERVICE CARD

inches for fanfold and 14.3 inches for cut sheet. According to the manual, fanfold paper can be set up in push-in or pull-out mode on the tractor feeder. When I tried the push-in mode, I found that the only way to get the paper over the platen involved turning the manual knob counterclockwise. This is counterintuitive and only results in paper getting torn up and thrown away.

Paper-handling problems dim when compared to the VP1821's emulation abilities. Simply put: you'll have a hard time finding software that will drive this printer. Centronics emulation is the only one available, and this is not on PC Labs' graphics or text emulation tests. While I could run text off an IBM Proprinter test emulation, graphics proved impossible.

A front control panel contains LEDs that indicate power and PE—for paper end. Separate membrane buttons exist for on-line, line feed, and form feed. A membrane button called mode sets the printer off-line and allows the user to select draft or near-letter-quality as well as pica and elite, condensed, enlarged, double, and emphasized type. All six typefaces are indicated by LEDs.

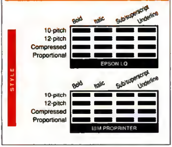
These days the print from an upper-end dot matrix printer should not shout "dot matrix" at first glance. Despite the 24-pin head, the VP1821's type does not seem remarkably different from that of a well-made 9-pin machine. Speed, at 90.9 characters per second in draft and 54.8 cps in NLQ, is lower than average.

One amusing thing about the VP1821 was its sound. Noise level averaged 72 dB, but the sound itself differed from any I've ever heard—somewhere between a music box and an old man whistling on a park bench.

The VP1821 comes equipped with a 6.5K buffer that cannot be upgraded. The only option is an RS-232C serial port with a maximum bit-per-second rate of 19.2 kilobits for $50.

This machine shows that a 24-pin printer can be sold for under $600. Given the VP1821's questionable quality and poor emulation abilities, the user looking in this price range would be better off either spending more money or looking at a solid 9-pin model.—**Gretchen Luchsinger**

Seikosha SBP-10AI



The Seikosha SBP-10AI is an impressive printer in many ways. It has a great variety of features designed to suit a number of business needs, and, at a back-breaking 72 pounds, its sturdy construction was obviously planned with heavy business use in mind. Its most impressive features are its speed—in draft mode, the SBP-10AI blazes along at a stunning 399 characters per second, which places it well ahead of anything else in its category—and its $4,495 price tag.

PC MAGAZINE FACT FILE

Seikosha SBP-10AI
Seikosha America Inc.
1111 MacArthur Blvd.
Mahwah, NJ 07430
(201)529-4655
List Price: $4,495
Dimensions (HWD): 10.75 x 26 x 25 in.
Weight: 72.8 lbs.
Emulations: Epson LQ; IBM Proprinter
In Short: This large 18-pin dot matrix printer produces good-quality type at almost blinding speeds and is ideal for companies that need to produce a lot of quick spreadsheets. However, its very high price may make you reconsider.
CIRCLE **635** ON READER SERVICE CARD

Like most sophisticated printers, the SBP-10AI is programmable. Its control panel, located at the top of the printer, contains an impressive display of membrane-button switches, some of which are numbered and most of which have at least two different tasks. Rather than using a single switch to toggle between, say, draft and near-letter-quality, you get a button for each menu choice. The buttons will change character width from 10 to 20 characters per inch, change type quality from draft to correspondence to NLQ, switch among up to three different fonts (which are accessed through removable cartridges), and change from fanfold paper to one of two cut-sheet bins.

To change one of the printer's settings, you hit a function switch and then key in the number of the feature category—a

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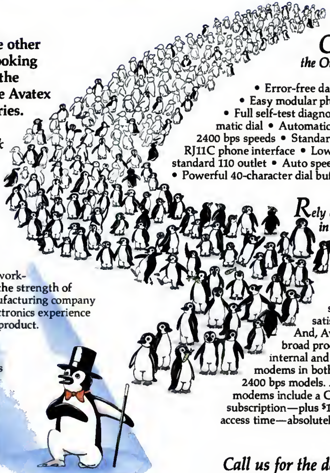

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CIRCLE 505 ON READER SERVICE CARD

somewhat inconvenient process, since you must refer to the manual to find out which number to use. You can then toggle to your new choice, using two keys labeled Dec and Inc (Decrease and Increase). Once you've set up the printer to your liking, you can save the new configuration in what Seikosha calls a *group*. You can create up to 10 groups with labels of 0 through 9; 0 is always the default and will come up with the printer.

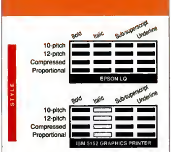
The SBP-10AI feeds in paper in several different ways. It will pull fanfold paper from the front or from the bottom. It can also push the paper through from the back. This enables the paper-parking feature, which lets you feed cut sheets into the printer without having to remove your fanfold paper. Cut sheets can be fed to the printer either automatically, using a bin that comes with the printer, or manually through a front slot that doubles as space for a bin.

The print quality of the printer is fine for an 18-pin printhead. The NLQ is clear and crisp, with only a bit of blurring on the *r*'s to betray it as a dot matrix printer. The correspondence quality, which is meant to be a halfway point between draft and NLQ, is adequate but rather jagged. I found the draft quality easier to read, although the dots were clearly visible.

The Seikosha SBP-10AI is a workhorse, built to replace the heavy-duty line printers that many companies use with minicomputers and mainframes.

The SBP-10AI is obviously a workhorse, built to replace the heavy-duty line printers that many companies use with minis and mainframes. Its incredible speed makes it a good machine for large firms whose needs cannot be filled by the present generation of laser printers. Whether that speed is worth about $4,500 is a good question that can be answered only by your accountant.—**Barbara Krasnoff**

Seikosha SL-130AI



The Seikosha SL-130AI is a nice entry into the ranks of medium-priced programmable printers. This low-slung, well-constructed 24-pin machine produces crisp, clean type in an impressive variety of fonts.

One way to check how well a printer has been designed is through its switch panel, and the SL-130AI has obviously been planned with care. It contains only five membrane switches, but these are clearly labeled for both their main uses—mode, LQ, line feed, form feed, and off-line/on-line—and their combinations. A series of LED lights above the switches lets you note what fonts and type sizes are presently in use. The panel is very clearly labeled; if you forget which button combination does what, a glance at the panel will set you right.

There are no DIP switches; you program the printer using the panel as well. By turning the printer on while holding down the Mode switch, you put it into Setup mode. In Setup mode, all the various settings are divided into four numbered groupings. The printhead acts as a pointer: you use the line feed and form feed keys to move it left and right. Once you've hit the right category (and you can have the printer list the features for each category, if you need to), it will print out the choices available for that category, underlining the current setting.

The print produced by the 24-pin printhead is top-class. I was especially impressed by the quality of the LQ mode. The draft mode was also nice: it looked jagged rather than made up of separate dots, and the lettering was a nice sans serif font. Users should be aware that the near-letter-quality produced by the printer's IBM emulation is only slightly better than draft quality. The real NLQ type is produced by the resident fonts, so it may take a bit of extra programming to produce them through your software. These fonts include Courier, Prestige, Boldface (a separate font, different from the bold setting); Gothic, Light Italic, Orator, OCR-A (a square, capitalized lettering), and OCR-B.

Tested speeds averaged 109.4 characters per second in draft mode and 56.6 cps in LQ mode.

There are some nice extras in the machine. A 1-inch cut feature will scroll the paper out to the end of the sheet and add an

FACT FILE

Seikosha SL-130AI
Seikosha America Inc.
1111 MacArthur Blvd.
Mahwah, NJ 07430
(201) 529-4655
List Price: $999
Dimensions (HWD): 5.5 x 22.5 x 13.5 in.
Weight: 26 lbs.
Emulations: Epson LQ-1000; IBM 5152 Graphics Printer
In Short: This well-designed 24-pin business printer includes a nice variety of fonts and good print quality. It is reset through a printed menu system rather than using an LCD screen; some users find this approach awkward, but it is very efficiently set up.
CIRCLE 634 ON READER SERVICE CARD

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Angus Dow
Customer Service Manager

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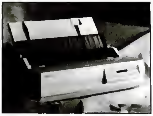
Barb Sesvold
Operations Manager



Epson's New LQ-2550 features high resolution, 24-pin letter quality printing and advanced paper handling capabilities. Epson's 24-pin technology prints crisp, clear text and graphics at a resolution up to 360 dpi. Seven color printing is another standard feature which adds the impact of color to charts, graphs and business reports. The LQ-2550 is a paper handling genius. Paper up to 16-inches wide and even six-part forms are easily handled by the LQ-2550.

"The LQ-2550 is my choice for two reasons: outstanding color and incredibly versatile paper handling features. This printer even automatically adjusts to the thickness of your forms!"

Bill Pratt
Corporate Sales

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Epson's DFX-5000 is a high speed, high volume dot-matrix printer for micros, minis and mainframes. Designed to perform in the most demanding printing environments, the DFX-5000 executes big printing jobs at near line printer speed. Two separate paper paths, rear feed and front bottom feed, provide enhanced flexibility. Prints 533 cps in SuperDraft, high speed utility mode. Front control panel allows access to advanced SmartPark paper handling features.

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M. Scott Zerby
Corporate Sales Manager

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Jeffrey M. Kreps
President

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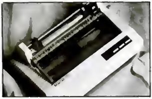
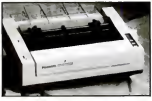


Citizen printers just became an even better value. In September, Citizen America announced new lower pricing on their complete line of printers. With unique features such as bottom feed, push/pull tractor and an 18 month warranty on most models, Citizen printers are a great value. We think the Tribute 124 and 224 have just the right combination of price and 24-pin letter quality performance to make them contenders for "Editor's Choice". All Citizen models in stock. Calll for new lower pricing.

Star Micronics printers have always been popular. The new NX-Series picks up where the Gemini 10-X left off—leading the pack for price and performance. The NX-1000 is our lowest priced printer to feature both push tractor and paper parking.. for only $179. Want color? The NX-1000 color version is only $249. Want the same features in a 24-pin letter quality printer? The NX-2400 at $349 is the best buy.

Brother printers are distinguished by their whisper quiet performance and compact design. The wide carriage M1509 is no bigger than most narrow carriage printers. It's small price— just $329—makes it a big winner for home or office. Many Brother printers like the M1709, at only $429, offer advanced paper parking, both serial and parallel ports and have side mounted connectors to keep cables away from your paper stack. Brother also builds the most complete line of daisy wheel printers. Most models in stock—call now for current pricing.



Panasonic printers are extremely rugged, built for business and backed by a industry leading two-year warranty. The 1080i and 1091i are the most popular but we think the wide carriage 24-pin at $529 or the incredible 4450 Laser offering HP emulation, dual bins and 11 ppm at only $1575 are best values. The soon-to-be-released KX-P1124 24-pin printer looks to be a real winner...call for pricing .

Okidata recently introduced the new 300 Series printer. We feel that Okidata has finally gotten back to the kind of quality printers which they used to be known for back in the days of the Model 92 and 93. Okidata printers feature bottom paper feed, as well as push tractor, paper parking and unique front panel programmability. Models 320 and 321 with 9-pin near letter quality, Models 292 and 293 with 18-pin letter quality color, and Models 390 and 391 with 24-pin letter quality are available.

Fujitsu printers are always highly rated for speed, print quality and durability. Although somewhat higher priced, Fujitsu printers are gaining popularity because of their unique features. Some models like the DL-2400 can use a triple bin cut-sheet feeder. The DL-5600 can handle eight-part forms. All models available.

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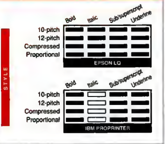
CIRCLE 355 ON READER SERVICE CARD

inch to make it easier to tear off. Hitting the on-line button will cause it to scroll back again. A park function scrolls the paper back, both to save you from "curl" and allow you to insert a cut sheet without having to remove your fanfold paper. This latter feature works very neatly: the guide rises to a vertical position to guide the paper in, and the sound cover meets it to help guide the paper out.

Altogether, the Seikosha SL-130AI is a very well-planned, efficient printer, and well worth a closer look.

—Barbara Krasnoff

Star Micronics NB 24-10



PC MAGAZINE FACT FILE

Star Micronics NB 24-10
Star Micronics America Inc.
200 Park Ave.
New York, NY 10166
(212) 986-6770
List Price: $749
Dimensions (HWD): 4.25 x 15.5 x 14 in.
Weight: 23.1 lbs.
Emulations: Epson LQ-1000; IBM Proprinter, 5152 Graphics Printer
In Short: The NB 24-10, although unbearably slow as a graphics printer, has enough fonts and features (and a reasonable enough price) to make it an interesting 24-pin choice for those with average word-processing needs.
CIRCLE **633** ON READER SERVICE CARD

At $749, the Star Micronics NB 24-10 is on the cheap side for 24-pin printers. And while its flimsy build makes me doubt that it would last forever, it does have enough interesting features to make it worth considering.

Print quality leaves something to be desired, despite the 24-pin head. At 24 by 9 dots per inch, draft mode churns out shaky lines of type—with the descenders on the *g*'s and *y*'s and *p*'s creeping into the line below. Near-letter-quality presents a decent face—the lines coming out clean and dark, if somewhat slowly at 49 characters per second. Draft pulls in at an average 91 cps. NLQ and draft modes are set on the front panel by pressing the membrane on-line button to take the printer off-line, and then pressing the quality button. Print pitches—proportional, elite, pica, and condensed—are chosen in the same way.

As a boon to eager desktop publishers without the means for a laser printer, several optional font cartridges can be purchased to use with the NB 24-10. Font cartridges are inserted in a slot on the lower-right-front side of the printer and include Letter Gothic, Courier, and Orator. List price is $60 per cartridge.

Emulations include Epson LQ-1000, IBM Proprinter, and the IBM 5152 Graphics Printer—each set by DIP switches located beneath a plastic shield under the ribbon. Graphics quality was better in the Epson LQ-1000 mode than in the IBM Proprinter mode, but in both cases the printer was so slow that I questioned whether it was worth the wait. At the tested output rate—an average of 208 seconds in the LQ mode and an average of 327 seconds in the Proprinter mode—even a simple presentation could turn into an ordeal.

The printer features several basic formatting functions that can be controlled by the keys on the front panel. Simultaneously pressing the on-line and the paper-feed or the top-of-form buttons gives you forward microfeed or reverse microfeed, respectively. A combination of the quality and top-of-form buttons sets the left margin, while a quality and paper-feed button combination sets the right. All buttons are large and easy to work with.

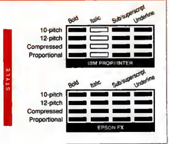
The NB 24-10 really starts to cost when it comes to memory. The basic 8K buffer can be expanded to 24K for $149. True memory junkies may seek out a 512K board for $340.

Other options include a 50-sheet automatic cut-sheet feeder for $99. Straight out of the box, the printer offers both an internal tractor feed for fanfold paper and a friction feed for cut-sheet paper. The printer automatically pulls the paper under and around the platen to the printhead when the release lever is pushed back to the autofeed setting. I had trouble with this during the testing and had to work the lever back and forth several times before the paper would feed.

If you are dying to own a 24-pin dot matrix printer, the NB 24-10 is a relatively cheap solution. Although it will never succeed in the world of graphics, this printer combines enough text features to make it worth a second look for the home or office with average word-processing needs.

—Gretchen Luchsinger

Star Micronics NR-10



It's hard to understand why the price tag on the 9-pin Star Micronics NR-10 dot matrix printer is $529. Performance and features

PC FACT FILE

Star Micronics NR-10
Star Micronics America Inc.
200 Park Ave.
New York, NY 10166
(212) 986-6770
List Price: $529
Dimensions (HWD): 4.25 x 15.5 x 14 in.
Weight: 22 lbs.
Emulations: Epson FX, IBM Proprinter, 5152 Graphics Printer
In Short: The NR-10 is pricey for a low-end 9-pin dot matrix printer. But a solid NLQ mode and an unobtrusive size and sound make it worth considering for an overcrowded individual office.

CIRCLE **632** ON READER SERVICE CARD

place this machine in competition with other printers that can be found for a couple of hundred dollars less.

Most of the action on the NR-10 takes place on the front control panel's membrane buttons. You can set print pitch—including pica, elite, condensed, and proportional—with the print pitch button, choosing draft or near-letter-quality with the mode button. For some strange reason, the printer consistently chose NLQ as the default mode when the power was turned on. An examination of the DIP switches—under a plastic cover beneath the ribbon—yielded no clues.

A dial on the front control panel allows you to set form length from 3½ to 14 inches, the default being 11 inches. The top-of-form button ejects a friction-fed cut sheet and feeds in a new page. This is a handy feature for printing out documents that are more than a few pages long. The paper-feed key advances the paper either by line or consecutively.

One of the truly annoying things about the NR-10 is the on-line button. None of the other controls can be accessed—including the most basic, the paper-feed key—until the printer is taken off-line. You will also find that every time you jar the front sound cover, the printer takes itself off-line. Instead of going back on-line automatically, the printer waits until you press the on-line button.

The NR-10's print quality is mediocre, with squashed descenders and *o*'s that don't always quite make it closed. NLQ mode isn't bad: the type is dark and crisp. Text speed in draft was decent at 108 characters per second, but NLQ was considerably slower, clocking in at 36 cps. If you are planning on printing graphics with this printer, make sure you have time. Our graphics speed test gave an Epson FX emulation time of 118 seconds and an IBM Proprinter time of close to 232 seconds. There was no difficulty with the emulations themselves: both the Epson FX and the IBM Proprinter emulations printed correctly.

Paper can be fed into the printer both through an internal tractor system or from a paper guide for cut sheets. A release lever on the left side of the machine automatically advances the paper. An optional automatic cut-sheet feeder that holds 50 sheets is available for $99.

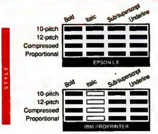
The NR-10 does sport lots of memory for those who need it. The minimum buffer is 12.6K; another $149 hikes it up to 28.6K. In addition, a 512K board is available for $340.

Most of the action on the Star NR-10 takes place on the front control panel's membrane buttons.

The NR-10 isn't the sturdiest printer around, and at $529 it's no bargain. It does have a comfortable array of basic dot matrix features, however, and its small footprint and fairly unobtrusive sound may warrant it a place in an individual office.

—Gretchen Luchsinger

Star Micronics NX-1000



	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

EPSON LX

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	■	□	■	■
Compressed	■	□	■	■
Proportional	■	□	■	■

IBM PROPRINTER

One class of printers is perfect for those of us who like the simple life: they are good, basic machines that offer a reasonable number of functions in a reasonably efficient manner for a reasonable amount of money. The Star Micronics NX-1000 belongs right at the head of this list.

The NX-1000 is a small-business 9-pin printer with a single sound cover that covers the printhead, ribbon, and platen. It emulates both the Epson LX-800 and the IBM Proprinter; you can set these and several other defaults through the DIP switches located under the printhead.

The printer's control panel is located on the front right-hand side at the top of the printer and contains four membrane switches. The first puts the printer on- and off-line. The second handles the paper feed. The third handles print pitch: by hitting the button, you can toggle through pica (10 characters per inch), elite (12 cpi), and condensed (17 cpi) pitches in either standard or proportional pitch. Typestyle is handled by the final button; the NX-1000 has three near-letter-quality resident fonts: Courier, Sanserif, and Orator.

The buttons have other uses, too: Star Micronics printers are known for the number of functions they crowd in using their membrane panels. There is a panel-lock mode that you can engage to override any

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conflicting signals from your software. You can also perform two different self-tests and use a hex dump mode as well.

The paper is loaded from the back, and this is one of the printer's less convenient features. To load fanfold paper, you have to remove the back cover, manually ease the paper through the platen, and then roll it up and around. This problem is alleviated by the NX-1000's paper-park function, which allows you to insert cut sheets without having to remove your fanfold paper.

As might be expected with a 9-pin printer, the print quality is acceptable but not perfect. Both the draft and the NLQ fonts are quite clear and readable; the fonts are nicely defined and different enough to give you a good choice. However, the NLQ is obviously the product of a dot matrix printer: the lettering is a bit jagged, especially at the curves.

This is probably not a printer you'd want to use for important business correspondence. But as an everyday office printer, the NX-1000 is definitely worth a look.**—Barbara Krasnoff**

FACT FILE

Star Micronics NX-1000
Star Micronics America Inc.
200 Park Ave.
New York, NY 10166
(212) 986-6770
List Price: $299
Dimensions (HWD): 4.5 x 15 x 15 in.
Weight: 10.3 lbs.
Emulations: Epson LX-800; IBM Proprinter
In Short: This handy 9-pin printer gives decent print quality at a good, solid pace. It would make an excellent second printer for a busy office.
CIRCLE 631 ON READER SERVICE CARD

Star Micronics NX-2400

STYLE

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

EPSON LQ

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	■	□	■	■
Compressed	■	□	■	■
Proportional	■	□	■	■

IBM PROPRINTER

The NX-2400 is obviously Star Micronics' attempt to produce a "yuppie" printer. Its literature proclaims it as a member of Star's "Signature Series," and there's an elegant logo on the front to prove it. But elegant or not, the NX-2400 is a good, solid 24-pin dot matrix machine with some very nice features.

The printer comes with a draft mode and four resident fonts: Courier, Prestige, Orator, and Script. You also have the option of buying a card that will give you an additional font. The draft, Courier, and Prestige fonts can all be italicized and printed in 12, 15, or 20 (condensed mode) characters per inch; proportional type is also available.

The printer's control panel has four switches: style/pitch, quiet mode, paper feed, and on-line. To change the font or type size, which are listed in two separate rows on the panel, you hit the style/pitch button. Each time you press the button, you get two tones, and the current setting of either the style or the pitch LCD flashes. You can then use the down and up cursors—the quiet mode and paper feed switches, respectively—to toggle to the setting you want.

The print quality is quite good. The draft mode yields clear, slightly jagged lines. The curves in the various near-letter-quality fonts are a bit rough if you look at them closely, but they will certainly pass muster for most applications.

The NX-2400 is not the quietest printer around: on the PC Labs test, it came out with a rating of 77 dB. The printer does have a quiet mode, which muffles the sound, pushing it down to 71 dB; but this also slows the printer down. The normal speed level is reasonable at 84.2 characters per second for draft and 38.8 cps for NLQ mode.

You load fanfold paper through the back and have to remove the back panel in order to get at the pin feed. Star Micronics favors rounded pin feeds that hug the platen, making it a bit harder to slide the paper into place without tearing off the sides. Once the paper is inserted, the printer chugs along with little problem.

Like most other Star Micronics printers, the NX-2400 uses its switches for a variety of functions. For example, a Stay In Panel function allows you to block any control codes that might interfere with any settings you make directly on the panel. You can also do a paper feed or a hexadecimal dump, clear the buffer, and do forward and reverse microfeed using various switch combinations.

With its attractive NLQ fonts and ease of operation, the NX-2400 is not a bad printer to have around the office.
—Barbara Krasnoff

FACT FILE

Star Micronics NX-2400
Star Micronics America Inc.
200 Park Ave.
New York, NY 10166
(212) 986-6770
List Price: $529
Dimensions (HWD): 4.75 x 16 x 17 in.
Weight: 14.1 lbs.
Emulations: Epson LQ-800; IBM Proprinter
In Short: This basic 24-pin printer is a bit loud and a bit slow, but it also offers a nice range of typefaces at a very reasonable price.
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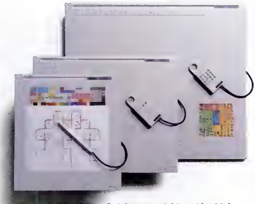

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The bad news is, this is a quiz. The good news is, we're going to make it easy.

All three of these 24-pin dot matrix printers are versatile, rugged office-quality printers. They all provide a variety of type styles and compatibility with most popular software. But there's only one Top Dot. And all the clues you need to find it are right here in this ad.

Top Dot's high performance features include combined letter-quality text and graphics, color printing, and a sizzling 480 cps draft speed.

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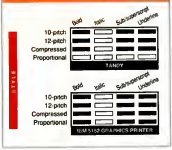
Tandy DMP 106



STYLE

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	☐	■	■
12-pitch	■	☐	■	■
Compressed	■	☐	■	■
Proportional	☐	☐	☐	☐

TANDY

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	☐	■	■
12-pitch	■	☐	■	■
Compressed	■	☐	■	■
Proportional	■	☐	■	■

IBM 5152 GRAPHICS PRINTER

The Tandy DMP 106 pretends to be neither the newest in dot-matrix printers nor anything more than a handy backup printer for your office. It had better not aim higher: the machine moseys along at a hair faster than 41 characters per second.

A first look at the 8.8-pound, $219.95 DMP 106 tells you a lot about what the vendor has trimmed away in its efforts to deliver a bottom-dollar, 7-pin printer. First, there's no on-line indicator other than your checking to see whether the button is up or down. The platen-release lever is the closest you get to a form-feed button, and unless you want to play with control codes, the paper-feed knob *is* your line feed.

Easily accessible switches in the rear let you switch from IBM mode (graphics printer emulation) to Tandy (text only) mode. Each mode uses its own distinct set of control codes. A 36-pin parallel cable can be used in either mode, and in Tandy mode you can use a special 4-pin serial cable instead and select a rate of either 600 or 2,400 bits per second.

Paper options range from 4- to 9½-inch fanfold or single-sheet paper (multiple copies permitted). Paper feeding from the rear is smooth except for the DMP 106's demand that your paper supply feed in at the precise angle required, with no variation whatsoever.

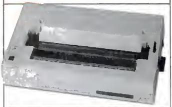
Noticeably absent is a sound-absorbent cover—a frill whose absence lands the backup printer in the backup office during use. The DMP 106 clatters along at 80 dB in draft mode and cries even louder while printing enhancements of its only font.

It is in print speed and quality, however, that the DMP 106 shows its mettle as a budget printer with no aspirations for the front lines of office productivity. Rated for 80 cps at 10 characters per inch, the printer delivered a little more than half that figure; in 12-cpi proportional spacing, it measured 28.3 cps. There's more: an average of more than 17 minutes to print one page of PC Labs' graphics speed test—with a degree of overinking and smudging.

If text alone will do, the DMP 106 offers a variety of printing enhancements in IBM mode, including super/subscripts and double-strike, as well as elongated and compressed characters. Formatting enhancements include variable form length, horizontal and vertical tabs, and variable line height. Don't look for near-letter-quality: neither mode supports near-letter-quality or high-speed drafts. Text output is adequate in 10 cpi, much better in proportional-spaced 12 cpi.

Tandy's DMP 106 makes no bones about its limitations. Pack it in your luggage to use away from your office. Keep it on hand for a reliable backup, or use it at

PC MAGAZINE FACT FILE



Tandy DMP 106
Tandy Corp.
1800 One Tandy Center
Fort Worth, TX 76102
(817) 390-3700
List Price: $219.95
Dimensions (HWD): 2.9 x 15.5 x 9.3 in.
Weight: 8.8 lbs.
Emulations: IBM 5152 Graphics Printer
In Short: A no-frills, portable 7-pin model that best serves as a backup printer. It offers IBM graphics emulation, but slow speed and average print quality make it a poor choice for day-to-day operations.

CIRCLE 630 ON READER SERVICE CARD

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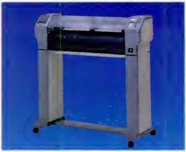

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CIRCLE 373 ON READER SERVICE CARD

home. If the budget is your driving force—and you're in no hurry—the DMP 106 is worth a good look.

—Edward L. Perratore

Tandy DMP 440

STYLE

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

TANDY

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	■	□	■	■
Compressed	■	□	■	■
Proportional	■	□	■	■

IBM 5152 GRAPHICS PRINTER

With its prosaic design and good performance, Tandy's DMP 440 dot matrix printer can be likened to a souped-up Chevy. Owners of this 9-pin printer won't be the envy of the neighborhood, but they will certainly enjoy yeomanlike service and will speed through print jobs faster than users of more cut-rate printers.

The DMP 440 does not have an IBM-compatible parallel interface, so step one for potential buyers is to make sure that the special cable for IBMs is available. If you try to use a basic cable, which seems to work with every other parallel printer under the sun, the unit will not operate or even perform a self-test.

This printer's oddball interface accommodates owners of Tandy computers, from the old TRS-80 on up, and is complemented by an equally odd serial interface, requiring a four-pin DIN connector, intended for Tandy's Color Computer.

To configure the DMP 440 as an IBM-compatible printer capable of displaying the full range of graphics characters, without double-spacing output, you have to change several DIP switches from their factory settings. This should not be a problem since the switches are easily accessible at the rear of the unit.

The documentation, replete with information and terminology germane to Tandy/Radio Shack computers and software, doesn't tell you that the DMP 440 in IBM mode yields best results when the Proprinter setting is selected.

Surprisingly light for a wide-carriage unit rated at 300 characters per second, the DMP 440 delivers a respectable 186 cps in draft mode and 47 cps in near-letter-quality. A pleasing variety of fonts and text enhancements can be produced. The tables in the manual describing control codes, however, are confusing and difficult to use for programming purposes.

The DMP 440's front panel contains the usual paper positioning controls and status indicators. In addition, the panel provides an NLQ mode switch and even allows you to set the left and right margins manually.

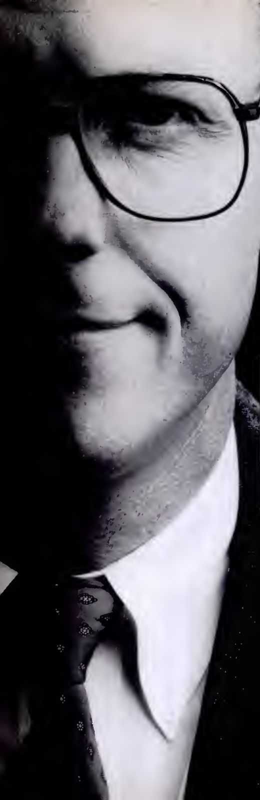
This printer is less than ideal for forms-printing applications. It does not handle anything thicker than three-part forms or offer variable form-length control. The position of the tractor requires orphaning off a form between runs, so a tear-off bar would have been superfluous.

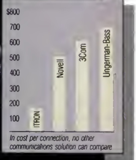
If the price of the DMP 440 were discounted to the extent common among oth-

PC MAGAZINE FACT FILE

Tandy DMP 440
Tandy Corp.
1800 One Tandy Center
Fort Worth, TX 76102
(817) 390-3700
List Price: $699
Dimensions (HWD): 4.8 x 20.8 x 13.2 in.
Weight: 17 lbs.
Emulations: IBM Proprinter
In Short: Fairly good bang for your buck, with nice output for a 9-pin printer. Construction and forms handling could be better. Little quirks may dissuade non–Tandy computer users.

CIRCLE [illegible] ON READER SERVICE CARD

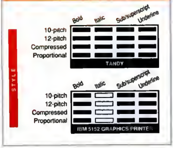




In cost per connection, no other communications solution can compare er brands, this printer would be a good value, despite its deficiencies, by dint of its speed and print quality. But Tandy list prices are usually the same as the selling prices. A price/performance evaluation versus competing printers on a street-price basis reveals the DMP 440 as something somewhat less than a great buy.

To legions of owners of discontinued Tandy computers attempting to upgrade or replace their printers, the DMP 440 may be a godsend. If you're working with a regular IBM or compatible and can't get an exceptional price on this unit, however, you will probably be happier in the long run if you look elsewhere.
—Gene Smilgiewicz

Tandy DMP 2120



Tandy, which has been making its name in recent years as a major producer of PC-compatible computers, has also been working on its printers. The DMP 2120, one of its new generation of printers, is being marketed both for Tandy machines and IBM clones.

This large 24-pin printer, which lists for $1,599, includes a draft mode and two near-letter-quality fonts: 10-pitch Courier and 12-pitch Prestige Elite. Its default control code setup is Tandy's, but it also emulates the IBM 5152 Graphics Printer.

These emulations, like most of the printer's other functions, are changed using the printer's membrane-switch panel, located on the forward right side of the printer's cover, and a 16-character LCD screen. The four switches have at least three functions each, all of which are labeled on the panel. The printer status (including on-line/off-line conditions and current typeface) is shown on the LCD.

You can change many of the printer's defaults by pressing the reset and on-line buttons simultaneously to put it into Function mode. There are six main functions: Style, which covers everything from printer emulation to print quality; Save, which

Printer Te

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TEXAS INSTRUMENTS

saves your settings into nonvolatile memory, allowing you to create your own default; List, which lists all the selection options on the screen at approximately 1-second intervals; Self-test; Hex Dump; and Default, which returns the system to the printer's default.

Type quality is quite good, which is to be expected from a 24-pin printer. The draft quality is acceptable; it appears jagged rather than visibly made up of separate dots. The NLQ fonts are clear, solid typefaces, though I did notice some blurring at the tails of the t's. And the printer's speed moved along at a very nice 166 characters per second in draft mode.

On the downside, the printer's parallel port follows the old Tandy wiring, so owners of PC compatibles will have to buy a special Tandy cable. It contains only two NLQ fonts, whereas many of its peers hold four or five. And the manual that comes with the program can be rather inscrutable, especially in the area of control codes: several minutes of intense searching were needed to find control codes for NLQ in the Tandy emulation.

Still, if you are looking for a good, solid 24-pin printer, the DMP 2120 should certainly be on your list of possibilities.

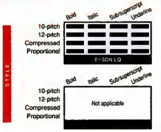
—Barbara Krasnoff

PC FACT FILE

Tandy DMP 2120
Tandy Corp.
1800 One Tandy Center
Fort Worth, TX 76102
(817) 390-3700
List Price: $1,599
Dimensions (HWD): 9 x 22 x 19½ in.
Weight: 49.5 lbs
Emulations: IBM Proprinter
In Short: This solid, speedy 24-pin printer has color capabilities and good-quality NLQ type, though its small number of fonts and insistence on Tandy emulation may prove limiting.

CIRCLE 627 ON READER SERVICE CARD

Texas Instruments Omni 800 Models 875 and 877



Texas Instruments' 24-pin Omni 800 Models 875 and 877 printers ($799 and $999, respectively) are nearly identical color dot-matrix printers that differ only in carriage width. The price differential between these two printers seems large if the only difference is a few inches of metal and plastic on which paper rests. The Model 875 prints up to 80 characters at 10 pitch, and the 877 prints 136. The four primary bands in the color ribbon permit six colors plus black.

Both models emulate the popular Epson LQ series printers: LQ-1500 for black and LQ-2500 for color. They can thus be

PC MAGAZINE FACT FILE

Texas Instruments Omni 800 Models 875 and 877

Texas Instruments
P.O. Box 181153
Austin, TX 78718
(800) 527-3500
List Price: Model 875, $799; Model 877, $999
Dimensions (HWD): Model 875, 5.6 x 18.5 x 15.8 in.; Model 877, 5.6 x 24.1 x 15.8 in.
Weight: Model 875, 30.9 lbs.; Model 877, 37.0 lbs.
Emulations: Epson LQ-2500
In Short: Inexpensive and unexceptional 24-pin four-color dot matrix printers.

CIRCLE 823 ON READER SERVICE CARD

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- text in different sizes and fonts, shadings, italics and underlines
- horizontal and vertical text on the same page
- import graphics and logos

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CIRCLE 356 ON READER SERVICE CARD

fully controlled by most word processing packages to produce underlined, bold, double-strike, italic, super- and subscript, and double-sized characters. If your word processor drives only a 9-pin Epson JX-80, you can use it, but your output will suffer aspect distortion.

LEDs indicate power-on, on-line, error condition, or paper-out. The latter two can signal by blinking as well as by simply staying lit and are accompanied by various tone signals according to the error.

There are also the standard on-line and reset (top-of-form) buttons, as well as line-feed, form-feed, and insert sheet. Insert sheet controls paper parking to reduce curling and lifts the paper bail when the paper scrolls into a flattened position. Above the last three buttons are alternative functions when you go into memory mode and press on-line and reset together.

Four more buttons let you toggle typestyle (internal and cartridge), print mode (draft, high-density, and letter quality), character pitch (10, 12, 17, and proportional) and line spacing (3, 4, 6, and 8). All toggled attributes can also be set by software, and you can panel-select whether the host word-processing program can override your manual settings. Battery-powered memory saves your defaults at power-down. The factory sets print mode to LQ for the narrow printer and draft quality for the wide.

Draft speeds for the printers were clocked at 104.6 characters per second for the Model 875 and 112.5 cps for the Model 877. Near-letter-quality was timed at 53.2 cps and 57.5 cps respectively.

The default typeface for these printers is a sterile Gothic, though the manufacturer says it will eventually migrate toward the more businesslike Courier. Additional font cartridges for Prestige Elite, Orator, Courier, and OCR-A are available for $65 apiece. You can also design your own fonts if you have the patience for it. Fabric ribbons cost $15 in black, $25 in color.

Other options available with these printers include a six-foot parallel cable ($35), a serial interface cartridge ($65), a 64K buffer upgrade over the installed 7K ($115), and a tractor feeder ($100 for the narrow model, $150 for the wide). A single-bin sheet-feeder ($225) can be upgraded to dual-bin for $150.—**Dean Hannotte**

Toshiba P321SLC

STYLE

QUME SPRINT 11	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

IBM PROPRINTER	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	■	□	■	■
Compressed	■	□	■	■
Proportional	■	□	■	■

Toshiba's new color printer ($949) may not make headlines, but it is good, solid, and could be an asset in business situations.

The compact, lightweight printer oper-

PC MAGAZINE FACT FILE

Toshiba P321SLC
Toshiba America Inc.
Information Systems Division
9740 Irvine Blvd.
Irvine, CA 92718
(714) 583-3000
List Price: $949
Dimensions (HWD): 6 x 16 x 15 in.
Weight: 18.6 lbs.
Emulations: IBM Proprinter; Qume Sprint 11
In Short: This small but powerful 24-pin color printer provides good print quality, fair print speed, and an especially user-friendly interface that lets you select printer defaults and menu choices.

CIRCLE 629 ON READER SERVICE CARD

ates through a 16-character LCD screen and six switches: Select, Eject, and two sets of buttons labeled "Prev." and "Next."

Although this is a very simple setup, it does give you options to a great variety of printer features. Toshiba has endowed the P321SLC with several different menu systems, all of which are accessible through the control panel. The first, the main menu, handles the options that Toshiba apparently decided were most often changed

PC MAGAZINE EDITOR'S CHOICE

- **ALPS Allegro 24**
- **IBM Quickwriter**
- **NEC Pinwriter 5200**
- **Okidata Microline 320 and 321**

At the low end of the 9-pin dot matrix market we found nothing this year that could beat the $289 Panasonic KX-P1091i, a 1987 Editor's Choice that is well on its way to becoming a classic. It's still in production and is available through many discount houses.

The most successful of this year's 9-pin crop is the 164-character-per-second Okidata Microline 320 (the 321 is the wide-carriage version). It's bigger, heavier, and $210 more expensive than the Panasonic, but there's no arguing with its extraordinary speed, output quality, ease of operation, and overall ergonomic design. It has good letter-quality output and can emulate Epson FX printers and the IBM Proprinter. It's good to see Okidata so strongly in the dot matrix printer game again.

For those who buy only IBM equipment, the more expensive 178-cps Proprinter III and wide-carriage Proprinter III XL ($649 and $899, respectively) carry on the top-quality Proprinter tradition.

This year's 24-pin winners are from traditional printer experts. At the low end, the ALPS Allegro 24 is a svelte, flatbed machine that produces outstanding LQ output at 72 cps for just $499. Though its speed isn't quite as good as its competitors', the value of the entire package is unmatched.

NEC has always had strong entries in the 24-pin printer market, and this year's Pinwriter 5200 (138 cps) is no exception. It's an outstanding value for the $799 price, offering quick, smooth performance with excellent-quality print.

Also keep in mind last year's Editor's Choice in this price range, the Epson LQ-850. Still available, and sometimes heavily discounted, this printer's bang-for-the-buck performance has withstood the test of time. It delivers 153 cps at the same $799 as the NEC machine.

The top-of-the-line 24-pin award goes to the exciting new IBM Quickwriter. The list price, $1,699, is no bargain, but with a draft speed of 222 cps, excellent output quality, a full range of paper-handling functions and options, the ability to take carbon ribbons for sharper letter-quality output, and rugged IBM construction, this is a printer without peer. The closest contender is Epson's LQ-2550. It's $200 cheaper than the IBM, but its speeds are about one-third slower than the Quickwriter's.

A special mention in the data processing category goes to the Epson DFX-5000, a 63-pound, $2,199 behemoth that spews forth printouts at 314 cps in high-speed-draft mode. Its ability to switch effortlessly between two separate tractor feeds is amazing to see.

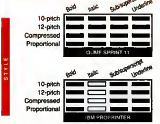
by users: pitch, emulation, lines per inch, quiet mode on/off, page length, and font. If you want to change such items as bidirectional printing or a carriage-return function, you go on to the extended menu. The Configure menu changes the printer's power-up configuration to any new defaults you wish (for example, you can have the printer come up in IBM Proprinter rather than Toshiba emulation); the Modify menu allows you to change the main menu to display only those options you want it to; and finally, the Print menu will cause the printer to produce either a test pattern or a listing of the present configuration.

The P321SLC will not break any speed records, but at about 102 characters per second draft and 47 cps near-letter-quality, it performs satisfactorily. It is also quiet; in normal mode it tested at 69 dB, way below many of its peers, and came down to a hushed (if slow) 66 dB in quiet mode. Type quality was also quite acceptable; the draft type was especially readable, and although I felt the NLQ Courier type was a bit too bold, the 12-character-per-inch Prestige Elite had a very clean, sharp look.

One cautionary note: although the P321SLC is highly recommended, Toshiba's technical assistance line is not. The first printer Toshiba sent us was flawed, and when I called Toshiba's help line, the man on the other end was brusque and impatient, and did not seem terribly knowledgeable about the printer (when I explained a problem I was having in printing a set of straight ASCII characters, he complained, "I can't do anything unless I have the software you're using").

The P321SLC is certainly not an inexpensive printer. But if you have some need for a color printer and you also want a printer that provides high-quality print and a flexible user interface, then the Toshiba P321SLC is a very good deal.
—Barbara Krasnoff

Toshiba P351SX



	Bold	Italic	Sub/superscript	Underline
10-pitch	■	■	■	■
12-pitch	■	■	■	■
Compressed	■	■	■	■
Proportional	■	■	■	■

QUME SPRINT 11

	Bold	Italic	Sub/superscript	Underline
10-pitch	■	□	■	■
12-pitch	■	□	■	■
Compressed	■	□	■	■
Proportional	■	□	■	■

IBM PROPRINTER

Toshiba was among the pioneers of the 24-pin dot matrix printer. Its line of 24-pin models has now entered its second generation, and the wide-carriage P351SX ($1,599) heads that line.

A two-line LCD on the front panel of the machine lets you display the printer's current and available settings one at a time. A set of membrane buttons controls the LCD and lets you browse through multi-level menus of print options. It's easy to make temporary changes in font, pitch, and other frequently altered settings from the simple main menu.

A particularly nice feature of the P351SX is that it automatically parks the tractor-feed paper when you pull the paper-bail lever forward. This keeps the paper from becoming curled over a long period of time. When you unpark the paper, the printer will automatically realign the top of the page with the printhead. And the best of all, is that you can load single sheets using friction-feed while the tractor-fed paper is parked.

Single-bin or dual-bin cut-sheet feeders are available as options, as well as a combination sheet/envelope feeder. We tested the Toshiba P351SX's sheet/envelope feeder and found that it generally performed well, although not without the occasional paper jam.

High-speed mode produces a respectably fast 186 characters per second in quite readable print, although horizontal lines have an annoying squiggle to them. The printer also offers four very attractive near-letter-quality fonts: Courier, Prestige Elite, an additional serif font, and a sans serif. Proportionally spaced NLQ type zips out at 105 cps, and it usually takes a rather close inspection to distinguish it from typewritten text.

You have the choice of several different pitches or proportional spacing for all NLQ fonts and pitches ranging from 10 to 20 characters per inch for the high-speed font. The printer also supports a full complement of enhancements such as italic, boldface, double-height, double-width, subscript, and superscript for all fonts. And Toshiba offers an assortment of downloadable fonts and plug-in font cartridges at extra cost.

The P351SX performed well on our graphics speed tests. In our high-order ASCII character test, it printed most of the characters with no problem. However, the printer forced us to enter escape codes to print most of the foreign language characters.

PC MAGAZINE FACT FILE

Toshiba P351SX
Toshiba America Inc.
Information Systems Division
9740 Irvine Blvd.
Irvine, CA 92718
(714) 583-3000
List Price: $1,599
Dimensions (HWD): 5 x 23 x 15.5 in.
Weight: 33 lbs.
Emulations: IBM Proprinter, 5152 Graphics Printer; Qume Sprint 11. Emulation cartridges available for Diablo 630, Epson JX (FX, MX, and RX compatible), and Epson LQ.
In Short: This easy-to-operate 24-pin printer offers some appealing built-in features, as well as a good range of add-ons. Its four NLQ type fonts are quite attractive.

CIRCLE **628** ON READER SERVICE CARD

In our testing we encountered one rather disturbing problem. The weight of the type would often vary inexplicably throughout a printed document, so that some parts appeared much darker than others. Sometimes the unevenness was very pronounced, while at other times it was barely noticeable, and it became less prominent as the ribbon became worn. We tested a second P351SX and found the same problem, but a new ribbon solved it. Since we have also experienced this problem with Toshiba's P321SL (the P351SX's narrow-carriage cousin) and its predecessor, the P321, it seems that it's inherent in either the design of this printer line or its ribbons.

The Toshiba P351SX offers versatility and a wide range of printing features. Its front-panel options menu and its paper-parking facility make it especially easy to use. The printer's tendency toward unevenly weighted printing, however, means you may not always be able to count on high-quality output.—**Robert Kendall**

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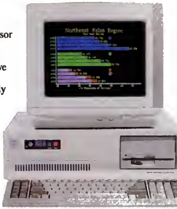

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Index to Printer Reviews (1984–1988)

In the 5-year history of the *PC Magazine* printer project, reviews of 483 printers have been published. Of this large and varied group, 298 printers are still in production or at least still available through retailers. This index lists each of those 298 machines—some of which have been around since 1984—along with the type of printer, the highest speed achieved in PC Labs benchmark tests, the name of a newer replacement model (where applicable), and current pricing information. Also listed are the volume, issue, and page number of the original review.

Note that from 1986 on, laser printer speeds have been measured in pages per minute (ppm) rather than characters per second (cps). The 123-cps rating of the Hewlett-Packard LaserJet turns out to be equivalent to 7.4 ppm. For detailed evaluations of the 90 new printers tested this year, see the reviews that precede the index.

Company name	Product	Type	Speed	Replaced by	Current price	Vol.	No.	Pg.	Reader service number
A									
Acer	LP-76	L	5.8 ppm		$1,999	7	18	112	667
Advanced Matrix Technology	AMT Accel-500	DM	182 cps		$1,285	7	18	234	697
Advanced Matrix Technology	AMT 250 Office Printer	DM (C)	160 cps	AMT Accel-500	$1,285	8	19	252	
ALPS	Allegro 24	DM	72 cps		$499	7	18	228	699
ALPS	ALQ200	DM	123 cps		$695	6	19	249	
ALPS	ALQ300	DM	123 cps		$995	6	19	249	
ALPS	ASP1000	DM	47 cps		$299	7	18	230	700
ALPS	LPX600	L	5.7 ppm		$2,795	7	18	114	665
ALPS	P2000	DM	138 cps		$995	5	19	201	
ALPS	P2100	DM	173 cps		$1,595	5	19	224	
ALPS	P2400C	DM	170 cps		$1,395	6	19	250	
ALPS	P2424C	DM	133 cps		$1,495	7	18	233	698
Apple	LaserWriter Plus	L	6.1 ppm	LaserWriter IINT	$4,599	5	19	298	
Apple	LaserWriter IINT	L	6.4 ppm		$4,599	7	18	116	666
Apple	LaserWriter IINTX	L	7.8 ppm		$6,599	7	18	116	666
AST	TurboLaser	L	7.5 ppm	TurboLaser/PS	$5,495	5	19	286	
AT&T	477	DM (C)	144 cps		$1,695	5	19	232	
Axonix	ThinWrite 100	DM	60 cps		$499	6	19	255	
B									
BDS	Laser 630/8	L	75 cps	Laser 630/8E	$2,495	4	19	176	
Blaser	The Blaser	L	6.7 ppm	Blaser Star 2	$2,395	5	19	270	
Blaser	BlaserStar	L	5.5 ppm	Blaser Star 2	$2,395	6	19	154	
Blaser	Blaser Ster 2	L	7.4 ppm		$2,395	7	18	120	664
Brother	HL-8	L	7.3 ppm		$2,695	7	18	123	663
Brother	HR-20	DW	21 cps		$549	8	19	380	
Brother	HR-40	DW	31 cps		$899	6	19	380	
Brother	M-1109	DM	53 cps		$299	5	19	146	
Brother	M-1509	DM	78 cps	M-1709	$749	5	19	160	
Brother	M-1709	DM	127 cps		$749	6	19	255	
Brother	M-1724L	DM	99 cps		$949	7	18	238	696
Brother	2024L	DM	71 cps	M-1724L	$949	5	19	212	
Brother	M-2518	DM	123 cps		$1,295	7	18	240	695
Brother	M-4018	DM	258 cps		$1,795	8	19	260	
Brother	Twinriter 5	DM/DW	77 cps	Twinriter 6	$1,395	5	19	212	
Brother	Twinriter 6	DM/DW	99 cps		$1,395	6	19	261	
C									
Canon	BJ-130	IJ	68 cps		$1,095	7	18	243	644
Canon	LBP-8II	L	7.4 ppm		$2,750	6	19	155	
Canon	LBP-8IIT	L	7.5 ppm		$3,950	7	18	126	653
Canon	PJ-1080A	IJ (C)	23 cps		$699	3	23	361	
CIE	LIPS 10 Plus	L	8.9 ppm		$3,295	6	19	158	
CIE	TriPrinter CI-3500 Model 20	DM	247 cps	TriPrinter C5000	$2,195	4	19	160	
Citizen	MSP-40	DM	105 cps		$499	7	18	244	694
Citizen	MSP-55	DM	119 cps		$829	7	18	245	671

C=color, DW=daisy wheel, DM=dot matrix, IJ=ink jet, L=laser, TT=thermal transfer, T=thimble

Index to Printer Reviews (1984–1988)

Company name	Product	Type	Speed	Replaced by	Current price	Vol.	No.	Pg.	Reader service number
D									
Citizen	Overture 110	L	10.3 ppm		$1,995	7	18	128	662
Citizen	Tribute 124	DM	102 cps		$749	7	16	248	693
Citizen	Tribute 224	DM	91 cps		$949	8	19	264	
C. Itoh	C-310 XP	DM	157 cps		$699	5	19	174	
C. Itoh	C-315 XP	DM	150 cps		$899	5	19	174	
C. Itoh	C-715A	DM	145 cps		$1,295	6	19	267	
C. Itoh	C-615	DM	195 cps		$1,995	8	19	268	
C. Itoh	CI-2500	DM	144 cps		$1,049	7	16	248	692
C. Itoh	Jet-Setter	L	4.9 ppm	Jat-Setter II	$2,195	8	19	162	
C. Itoh	Jet-Settar II	L	4.9 ppm		$2,195	7	18	145	643
C. Itoh	LIPS II	L	9 ppm		$3,545	7	18	147	652
C. Itoh	Printmaster F10-55	DW	45 cps	StarWriter F10-55	$1,749	3	23	311	
C. Itoh	ProWriter C-310 CXP	DM	177 cps		$749	6	19	270	
C. Itoh	ProWriter jr. Plus	DM	72 cps		$369	6	19	272	
C. Itoh	StarWriter D10-40	DW	31 cps		$1,049	5	19	330	
C. Itoh	Triprinter CI-5000	DM	247 cps		$1,995	7	18	250	691
C. Itoh	8510SP	DM	86 cps		$569	3	23	142	
Copal USA	Writehand 5930	DM	173 cps		$1,195	7	16	253	870
Copal USA	Writehand 8730	DM	91 cps		$995	7	18	255	890
D									
Daisy Systems	M45Q	DM	37 cps		$995	3	23	313	
Data Technology	CrystalPrint VIII	L	8 ppm		$2,495	8	19	168	
Dataproducts	LZR 1230	L	8 ppm		$3,695	6	19	187	
Dataproducts	LZR 1260	L	10 ppm		$7,995	7	18	149	851
Dataproducts	SI 480	IJ	288 cps		$2,795	7	18	255	687
Dataproducts	6070 Plus	DM	250 cps		$1,595	7	16	261	689
Dataproducts	9044	DM	102 cps		$1,099	7	18	262	688
Datasouth	DS 180	DM	126 cps		$1,395	3	23	223	
Datasouth	DS 220	DM	150 cps		$1,695	3	23	226	
Destiny	Laser Act I	L	5.8 ppm		$2,395	8	19	177	
Diconix	150	IJ	65 cps		$479	5	19	158	
Diconix	300	IJ	96 cps		$599	7	18	264	686
Diconix	300w	IJ	96 cps		$749	7	18	264	686
Digital Equipmant Corp.	LA 210	DM	138 cps		$1,760	3	23	213	
Digital Equipment Corp.	LN03	L	7.4 ppm		$2,895	5	19	278	
F									
Epson	DFX-5000	DM	266 cps		$2,199	7	16	287	685
Epson	EX-800	DM	115 cps		$699	5	19	178	
Epson	FX-86E	DM	129 cps		$549	6	19	272	
Epson	FX-286E	DM	138 cps		$799	8	19	272	
Epson	FX-850	DM	136 cps		$549	7	18	267	684
Epson	FX-1050	DM	138 cps		$799	7	18	287	684
Epson	GQ-3500	L	5.4 ppm		$2,499	8	19	176	
Epson	LQ-500	DM	86 cps		$495	7	18	268	683
Epson	LQ-800	DM	105 cps	LQ-850	$849	5	19	185	
Epson	LQ-850	DM	153 cps		$849	8	19	275	
Epson	LQ-950	DM	126 cps		$949	7	18	274	682
Epson	LQ-1000	DM	105 cps	LQ-1050	$1,199	5	19	185	
Epson	LQ-1050	DM	163 cps		$1,199	6	19	275	
Epson	LQ-2500	DM	104 cps		$1,449	5	19	226	
Epson	LQ-2500	DM (C)	133 cps		$1,449	6	19	276	
Epson	LQ-2550	DM	138 cps		$1,499	7	18	278	681
Epson	LX-800	DM	105 cps		$299	8	19	283	
F									
Facit	B3100	DM	149 cps		$745	8	19	284	

C=color, DW=daisy wheel, DM=dot matrix, IJ=ink jet, L=laser, TT=thermal transfar, T=thimbla

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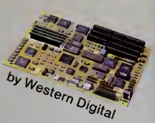

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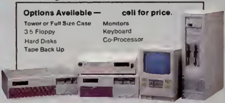

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Index to Printer Reviews (1984–1988)

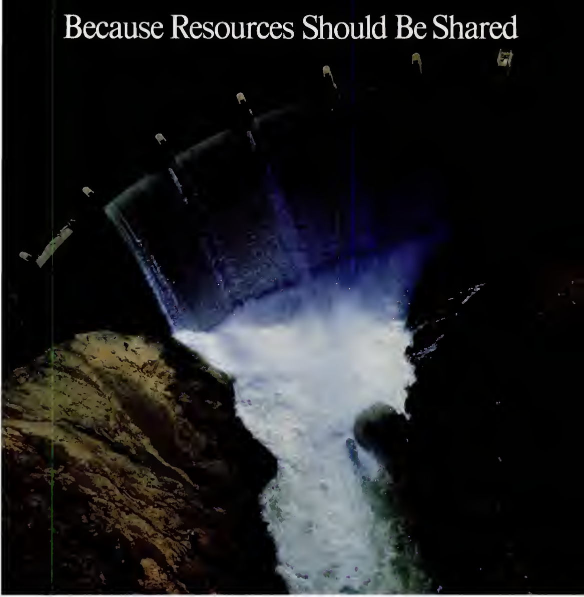
Company neme	Product	Type	Speed	Replaced by	Current price	Vol.	No.	Pg.	Reader service number
F									
Facit	B3150	DM	154 cps		$895	6	19	284	
Facit	B3350	DM	136 cps		$995	6	19	286	
Facit	D2000	DM	25 cps		$795	5	19	319	
Florida Date	OSP 130	DM	314 cps	Model 130	$3,995	3	23	243	
Fortis	DM1310	DM	93 cps		$299	6	19	288	
Fortis	DM2010	DM	115 cps		$479	5	19	156	
Fortis	DM2015	DM	102 cps		$599	5	19	156	
Fortis	DX41	DW	31 cps		$799	6	19	383	
Fujitsu	DL2400	DM	111 cps		$1,495	5	19	220	
Fujitsu	DL2600	DM	170 cps		$1,545	6	19	288	
Fujitsu	DL3400	DM	143 cps		$925	8	19	291	
Fujitsu	DL5600	DM	230 cps		$2,195	7	18	276	669
Fujitsu	DX2300	DM	129 cps		$645	6	19	292	
Fujitsu	DX2400	DM	157 cps		$845	6	19	292	
Fujitsu	SP320	DW	41 cps		$1,395	3	23	324	
Fujitsu	SP320E	DW	41 cps		$1,595	5	19	338	
G									
Genicom	Centronics PagePrinter 8	L	7.5 ppm		$2,295	6	19	179	
Genicom	Centronics Printstation 220	DM	99 cps		$655	6	19	297	
Genicom	Centronics Printstation 240	DM	84 cps	Centronics Printstation 220	$655	4	19	152	
Genicom	Centronics Printstation 351 PC	DM	144 cps		$1,850	4	19	164	
Genicom	1020	DM	111 cps		$1,065	5	19	194	
Genicom	3310/Color	DM (C)	150 cps		$2,295	5	19	252	
Genicom	3320 Quiet	DM	144 cps		$2,395	4	19	166	
Genicom	3410	L	230 cps		$2,450	4	19	170	
Genicom	5010	L	8.5 ppm		$3,395	6	19	182	
Genicom	GLP	DM	29 cps		$320	3	23	154	
I									
Hermes	615 Professional Color Printer	DM (C)	96 cps		$2,995	4	19	174	
Hermes	PC-4	DM (C)	173 cps		$2,995	5	19	254	
Hermes	Parsonel Computar Printer I	DM	128 cps		$1,195	4	19	161	
Honeywell-Bull	Bull 4/66	DM	235 cps		$2,400	6	19	302	
Hewlett-Packard	DeskJet	IJ	61 cps		$995	7	18	279	624
Hewlett-Packard	LaserJet	L	123 cps		$3,495	3	23	394	
Hewlett-Packard	LaserJet 500 Plus	L	7.4 ppm		$4,495	5	19	288	
Hewlett-Peckard	LaserJat Series II	L	7.5 ppm		$2,595	6	19	185	
Hewlett-Packard	PaintJet	IJ	78 cps		$1,395	6	19	297	
Hawlett-Packard	RuggedWriter	DM	173 cps		$1,695	7	18	280	621
Hewlett-Packard	ThinkJet	IJ	70 cps		$495	3	23	172	
I									
IBM	4216 Parsonal Pageprinter	L	5.6 ppm		$4,999	7	18	150	650
IBM	Proprinter II	DM	129 cps		$549	6	19	304	
IBM	Proprinter II XL	DM	111 cps		$799	7	18	282	622
IBM	Proprinter III	DM	173 cps		$649	7	18	285	668
IBM	Proprinter III XL	DM	173 cps		$899	7	18	285	668
IBM	Proprinter XL	DM	119 cps		$799	5	19	186	
IBM	Proprinter X24	DM	172 cps		$799	8	19	307	
IBM	Quickwritar	DM	192 cps		$1,699	7	18	285	660
IBM	Quietwriter Model 2	TT	28 cps		$1,399	5	19	226	
IBM	Quietwriter III	TT	81 cps		$1,899	6	19	312	
Imagen	Innovator ImageStation	L	7 ppm	ImageStation 15	$5,595	5	19	299	
Infoscribe	800	DM	108 cps		$1,795	5	19	245	
Infoscribe	1100	DM	102 cps		$1,590	7	18	286	680
Infoscribe	1400	DM	173 cps		$1,845	7	18	290	679

C=color, DW=daisy wheel, DM=dot matrix, IJ=ink jet, L=laser, TT=thermal trensfer, T=thimble

Index to Printer Reviews (1984–1988)

Company name	Product	Type	Speed	Replaced by	Current price	Vol.	No.	Pg.	Reader service number
K									
Kyocera	F-1000A	L	6.4 ppm		$2,695	7	16	152	619
Kyocera	F-1010	L	9.2 ppm	F-1000A	$2,895	6	19	186	
Kyocera	F-2010	L	6.8 ppm		$4,695	6	19	188	
Kyocera	F-3010	L	16 ppm		$8,395	6	19	190	
L									
Laser Connection	Big Kiss II	L	7.5 ppm		$4,495	6	19	192	
Laser Connection	PS Jet	L	6.3 ppm	PS Jet Plus	$2,995	6	16	194	
M									
Mannesmann Tally	85	DM	69 cps		$499	5	19	164	
Mennesmenn Tally	67	DM	113 cps		$599	6	19	317	
Mannesmann Tally	90	IJ	101 cps		$799	6	16	317	
Mannesmann Telly	222	DM	89 cps		$899	7	18	291	659
Mannesmann Tally	230/24	DM	108 cps		$1,499	7	18	291	678
Mannesmann Tally	290	DM	133 cps		$1,199	5	19	208	
Mannesmann Tally	330	DM	190 cps		$1,676	6	19	320	
Mannesmann Tally	340	DM	150 cps		$2,276	7	16	292	658
Mannesmann Tally	490	DM	247 cps		$2,799	5	19	250	
Mennesmenn Tally	910	L	9 ppm		$3,695	8	16	167	
MPi	Solution Series SX	DM	116 cps		$795	4	19	142	
N									
NEC	Pinwriter P5XL	DM (C)	123 cps		$1,295	5	19	232	
NEC	Pinwriter P7	DM	111 cps		$1,049	5	19	206	
NEC	Pinwriter P9XL	DM	157 cps		$1,595	6	19	322	
NEC	Pinwriter 2200	DM	52 cps		$569	7	16	295	677
NEC	Pinwriter 5200	DM	138 cps		$799	7	16	296	676
NEC	Silentwriter LC-650	L	7.5 ppm		$2,595	6	19	198	
NEC	Silentwriter LC-890	L	6 ppm		$4,795	6	19	200	
NEC	Spinwriter 3550	T	30 cps		$1,297	3	23	342	
NEC	Spinwriter 8850	DW	44 cps		$1,865	4	16	157	
O									
Office Automation Systems	LaserPro Express	L	7.4 ppm		$1,995	6	19	202	
Office Automation Systems	LaserPro Express Series II	L	7.4 ppm		$2,495	6	16	205	
Office Automation Systems	LaserPro Gold Express	L	7.2 ppm		$3,895	7	18	154	646
Office Automation Systems	LaserPro Silver Express	L	7.4 ppm		$2,995	6	19	208	
Office Automation Systems	LaserPro 610R	L	7.5 ppm		$4,195	5	19	292	
Office Automation Systems	LaserPro 1510R	L	13.5 ppm		$6,495	7	16	156	648
Okidata	Laserline 6	L	5.6 ppm		$2,145	6	19	213	
Okidata	Microline 162 (IBM)	DM	80 cps		$299	5	6	149	
Okidata	Microline 162 (Standard)	DM	80 cps		$309	5	6	151	
Okidata	Microline 162 Plus	DM	105 cps	Microline 320	$499	5	19	156	
Okidata	Microline 193 Plus	DM	105 cps	Microline 321	$699	5	19	156	
Okidata	Microline 292 (Standard & IBM)	DM	132 cps		$649	5	19	174	
Okidata	Microline 293 (Standard & IBM)	DM (C)	123 cps		$846	5	19	174	
Okidata	Microline 294	DM (C)	182 cps		$1,199	5	19	216	
Okidata	Microline 320	DM	164 cps		$499	7	16	300	675
Okidata	Microlina 321	DM	157 cps		$699	7	16	300	675
Okideta	Microline 390	DM	144 cps		$699	7	16	300	674
Okidata	Microline 391	DM	136 cps		$949	7	18	300	674
Okidata	Microline 393	DM	170 cps		$1,399	6	19	326	
Okideta	Microline 393C	DM (C)	163 cps		$1,499	7	16	302	873
Okidata	Okimete 20	TT (C)	26 cps		$268	4	19	97	
Okideta	Pecemerk 2410	DM	216 cps		$2,365	4	19	168	
Olivetti	DM280	DM	82 cps		$595	5	19	172	
Olivetti	DY450	DW	43 cps		$1,499	5	19	340	

C=color, DW=daisy wheel, DM=dot matrix, IJ=Ink jet, L=laser, TT=thermal transfer, T=thimble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Index to Printer Reviews (1984–1988)

Company name	Product	Type	Speed	Replaced by	Current price	Vol.	No.	Pg.	Reader service number
O									
Olivetti	DY800	DW	55 cps		$1,899	5	19	344	
Olympia	ESW 1000C	DW	13 cps	ESW 2000i	$749	5	19	311	
Olympia	ESW 2000C	DW	22 cps	ESW 2000i	$749	5	19	311	
Olympia	Laserstar 8	L	4.7 ppm		$2,699	7	18	158	647
Olympia	NP30	DM	93 cps		$299	6	19	329	
Olympia	NP80	DM	142 cps	NP 80S	$499	6	19	329	
Olympia	NP136	DM	140 cps	NP136S	$649	6	19	329	
Output Technology Corp.	700e	DM	185 cps	700n TriMatrix	$2,095	5	19	245	
Output Technology Corp.	700n TriMatrix	DM	192 cps		$2,095	5	19	246	
Output Technology Corp.	TriMatrix 850XL	DM	307 cps		$2,395	6	19	330	
P									
Panasonic	KX-P1080i	DM	90 cps		$300	6	19	332	
Panasonic	KX-P1091i	DM	99 cps		$330	6	19	336	
Panasonic	KX-P1092i	DM	113 cps		$530	6	19	336	
Panasonic	KX-P1524	DM	118 cps		$949	6	19	339	
Panasonic	KX-P1592	DM	121 cps		$680	6	19	342	
Panasonic	KX-P1595	DM	138 cps		$770	5	19	201	
Panasonic	KX-P3131	DW	17 cps		$500	6	19	384	
Panasonic	KX-P3151	DW	22 cps		$800	4	19	128	
Panasonic	Laser Partner	L	10.1 ppm		$2,595	7	18	161	646
Personal Computer Products	LaserImage 2000	L	7.5 ppm		$3,495	8	19	214	
Personal Computer Products	LaserImage 3000	L	7.3 ppm		$6,395	6	19	216	
Primages	Primage 90GT	DW	56 cps		$1,095	6	19	386	
Printek	910 HT	DM	144 cps		$1,325	3	23	214	
Printek	920 HT	DM	203 cps		$1,895	3	23	253	
Printek	930	DM	111 cps		$1,695	3	23	215	
Printek	FormsPro 2000	DM	111 cps		$2,095	5	19	247	
Printronix	L1012	L	9.9 ppm		$3,495	8	19	218	
Printronix	P1013 Personal Line Printer	DM	99 cps		$895	5	19	182	
Printronix	S-7024	DM	151 cps		$1,365	6	19	394	
Printware	720 IQ Laser Imager with 1200 HD Image Processor	L	6.7 ppm		$12,980	6	19	221	
Q									
Qantex	7035	DM	123 cps		$1,795	3	23	218	
Qantex	7065	DM	192 cps		$2,395	3	23	218	
QMS	Kiss	L	7.4 ppm	Kiss Plus 30	$3,920	5	19	268	
QMS	Kiss Plus 30	L	7.5 ppm		$3,920	7	18	163	642
QMS	Lasergrafix 800	L	115 cps		$6,495	4	19	180	
QMS	PS-800 Plus	L	6.1 ppm	PS-810	$5,495	6	19	222	
QMS	PS-810	L	6.7 ppm		$5,495	7	18	165	645
Quadram	Quadlaser I	L	7.5 ppm		$3,495	6	19	226	
Qume	CrystalPrint Series II	L	5.8 ppm		$1,999	7	18	167	657
Qume	CrystalPrint WP	L	5.8 ppm		$1,299	7	18	173	656
Qume	LaserTEN	L	8.8 ppm	LaserTENPlus	$3,395	5	19	271	
Qume	LaserTENPlus	L	8.8 ppm		$3,395	6	19	229	
Qume	LetterPro Plus	DW	41 cps		$799	5	19	328	
Qume	ScripTEN	L	8.2 ppm		$4,495	7	18	174	655
Qume	Sprint 11/55 Plus	DW	54 cps		$1,495	3	23	340	
Qume	Sprint 11/90 Plus	DW	63 cps		$1,895	4	19	172	
Qume	Sprint 11 Plus Widetrack	DW	38 cps		$2,750	4	19	174	
R									
RCA	VP2100	DM	51 cps	Cardinal Tech. DP 2100	$349	5	19	151	
Relisys	RP1814	DM	99 cps		$225	7	18	305	672
Relisys	RP2410	DM	93 cps		$259	7	18	306	637

C=color, DW=daisy wheel, DM=dot matrix, IJ=ink jet, L=laser, TT=thermal transfer, T=thimble

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CIRCLE 139 ON READER SERVICE CARD

Index to Printer Reviews (1984–1988)

Company name	Product	Type	Speed	Replaced by	Current price	Vol.	No.	Pg.	Reader service number
R									
Relisys	VP1821	DM	91 cps		$599	7	18	306	636
Ricoh	PC Laser 6000	L	6 ppm		$2,495	6	19	230	
S									
Sanyo	PR-241	DM	111 cps		$899	6	19	346	
Seiko	DPU-40	TT	14 cps		$125	3	23	155	
Seikosha	BP-5420AI	DM	216 cps		$1,849	5	19	238	
Seikosha	MP-1300AI	DM (C)	119 cps	SK-3000AI	$649	5	19	194	
Seikosha	MP-5300AI	DM	190 cps	SK-3005 AI	$849	8	19	346	
Seikosha	SBP-10AI	DM	314 cps		$4,495	7	18	309	635
Seikosha	SK-3000AI	DM	172 cps		$649	6	19	349	
Seikosha	SK-3005AI	DM	170 cps		$849	6	19	349	
Seikosha	SL-80AI	DM	60 cps		$549	6	19	354	
Seikosha	SL-130AI	DM	93 cps		$999	7	18	311	634
Seikosha	SP-1000	DM	51 cps		$299	5	19	151	
Seikosha	SP-1200AI	DM	91 cps		$319	6	19	358	
Sharp	JX-9300	L	6.1 ppm		$2,195	7	18	177	854
Silver-Reed	EXP-770	DW	34 cps	EXP-800	$999	3	23	317	
Star Micronics	LaserPrinter 8	L	7.4 ppm		$2,799	7	18	178	620
Star Micronics	NB-15	DM	184 cps		$1,399	5	19	222	
Star Micronics	NB 24-10	DM	91 cps		$749	7	18	315	633
Star Micronics	NB 24-15	DM	125 cps		$999	6	19	358	
Star Micronics	NR-10	DM	108 cps		$529	7	18	315	632
Star Micronics	NR-15	DM	151 cps		$799	6	19	361	
Star Micronics	NX-10	DM	74 cps	NX-1000	$299	5	19	154	
Star Micronics	NX-15	DM	84 cps		$529	6	19	367	
Star Micronics	NX-1000	DM	71 cps		$299	7	18	316	631
Star Micronics	NX-2400	DM	84 cps		$529	7	18	318	625
T									
Tandy	DMP 106	DM	41 cps		$220	7	18	321	630
Tandy	DMP 440	DM	150 cps		$699	7	18	323	626
Tandy	DMP 2110	DM	123 cps	DMP 2120	$1,599	5	19	216	
Tandy	DMP 2120	DM	138 cps		$1,599	7	18	325	627
Tandy	LP 1000	L	5.9 ppm		$2,599	7	18	181	641
Taxan	Crystal Jet	L	4.6 ppm		$3,495	7	18	185	640
Tektronix	4696	IJ (C)	26 cps		$1,795	6	19	387	
Texas Instruments	850XL	DM	96 cps		$599	3	23	166	
Texas Instruments	855	DM	102 cps		$739	3	23	195	
Texas Instruments	855 Demand Document Printer	DM	195 cps		$2,295	6	19	365	
Texas Instruments	865	DM	96 cps		$999	5	19	208	
Texas Instruments	875	DM	105 cps		$799	7	18	329	623
Texas Instruments	877	DM	113 cps		$999	7	18	329	623
Texas Instruments	880 AT	DM	172 cps		$2,195	5	19	252	
Texas Instruments	OmniLaser 2015	L	7.1 ppm		$5,995	5	19	296	
Texas Instruments	OmniLaser 2106	L	5.5 ppm		$4,595	7	18	188	639
Texas Instruments	OmniLaser 2108	L	7.4 ppm		$5,995	6	19	232	
Texas Instruments	OmniLaser 2115	L	9.5 ppm		$7,995	8	19	234	
Toshiba	PageLaser12	L	11.4 ppm		$3,799	7	18	190	638
Toshiba	P321SL	DM	120 cps		$799	6	19	370	
Toshiba	P321SLC	DM (C)	102 cps		$949	7	18	331	629
Toshiba	P341SL	DM	125 cps		$1,049	6	19	370	
Toshiba	P351C	DM (C)	163 cps	P351SX	$1,599	6	19	368	
Toshiba	P351SX	DM	150 cps		$1,599	7	18	333	628
VX									
Varityper	VT-600	L	5.8 ppm		$16,995	6	19	237	
Xerox	4045 Laser CP	L	9.2 ppm		$4,995	5	19	294	

C=color, DW=daisy wheel, DM=dot matrix, IJ=ink jet, L=laser, TT=thermal transfer, T=thimble

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■ **PC LAB NOTES:** BATCH FILES ■ NORMAN HALE

ADVANCED BATCH-FILE TECHNIQUES

Unleash the hidden power inside your ordinary batch files. Here are some tips and techniques you can use to make your batch files more productive and efficient.

Most PC users understand how to create and use batch files. But because of a general lack of information, many don't fully appreciate their potential power. The power of batch files lies not so much in their ability to carry out a series of successive operations, but more in their advanced and lesser-known peculiarities.

Some of these attributes are poorly documented; some are facts about DOS rather than exclusively about batch files (and yet they are useful when working with batch files); some, indeed, are not facts but simply methods or ideas.

First, I'll review the special commands that DOS provides for dealing with batch files. Some of them are very useful while others are trivial. The syntax for each of these commands is shown in Figure 1.

IF is used for testing conditions in batch files. GOTO allows parts of a batch file to be bypassed and is used for creating "loops" within a batch file. SHIFT is used to process a list of operands in succession. CALL, a relatively new command, invokes one batch file from another as a subroutine. The ECHO command, often used with redirection, can be used to create or expand batch files, data files, and programs. With piping, it can send commands directly to BASIC and to utilities. Finally, the FOR command instructs DOS to repeat the same command many times with different data. These commands along with parameters from the command line and the environment provide the basis for a thorough understanding of batch file techniques.

REPLACEABLE PARAMETERS The IF, GOTO, and SHIFT commands are used, for the most part, in connection with loops and repetitive processing based on command-line parameters. First, therefore, let's understand how replaceable parameters operate.

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Whenever the batch file processor encounters a percent sign (%) in a line followed by a digit from 1 to 9, these two characters are "resolved" before the line is processed—that is, they are replaced by the value which they represent. This value consists of one or more characters taken from the command line that invoked the batch file. The line is scanned for delimiters (you can use commas if you like, but spaces will do just as well), which are assumed to separate the parameters. Thus, the command

```
MOVE TRAP.ASM HERE THERE
```

might move a file called TRAP.ASM from a directory called HERE to another directory called THERE. However, since there is no such DOS command, this function must be performed by a batch file that uses replaceable parameters. The first parameter, the name TRAP.ASM, will become the value of %1 when used in the batch file. Likewise, HERE and THERE will replace %2 and %3, respectively. Therefore, if the expression \%2\%1 is found in any of the commands in the batch file, it will be resolved to

```
\HERE\TRAP.ASM
```

which is its "value" after replacing each percent sign (%) reference with the corresponding parameter. This is one type of "resolution" that occurs during the processing of a batch file. Another type is the resolution of references to environment variables.

Batch File Commands

CALL

CALL filename

Loads and executes a batch file from within a batch file as if it were an external command. .When the second batch file completes, control is returned to the calling file. (Available in DOS 3.3 and later.)

ECHO

ECHO [ON | OFF | message]

Controls whether commands and comments within a batch file are displayed.

FOR

FOR %argument in (list) do command

Repeats the operation of a DOS command for each member of a list.

GOTO

GOTO label

Transfers control within a batch file to a line identified by a label. The label must be of the form ":label".

IF

IF condition command

Tests a condition and performs a command depending on the result. The following conditions are available for testing:

- **ERRORLEVEL number**
  - Will be true if the previous program returned an exit code equal to the specified (decimal) number or higher.
- **string1 == string2**
  - Will be true if both strings are identical. The comparison is case sensitive, so A==a is false. A blank string cannot be used.
- **EXIST filename**
  - Will be true if *filename* can be located. The filename can include a drive and path specification. Wildcards are also allowed.

PAUSE

PAUSE [message]

Pauses the running of a batch file and displays the message "Press any key to continue..." on the screen. If the optional message is included, it will be displayed first.

REM

REM remark

Adds remarks to a batch file.

SHIFT

SHIFT

Shifts any parameters on the command line one position to the left. Use this to refer to multiple parameters by one name or to use more than ten parameters on a single command line.

Figure 1: *Any DOS command can be placed in a batch file, but additional control is provided by using the appropriate batch file commands shown above.*

ENVIRONMENT VARIABLES The SET command will position expressions of the form

```
name=value
```

into the environment, where *name* is a single word and *value* is any string of characters. The SET command can be issued from the keyboard or as part of a batch file. The use of variables in the environment is possible in batch files only.

If the command

```
SET SOURCE=FILES.LST
```

is issued, the value FILES.LST will be in the environment, represented by the name SOURCE. A value can be referred to by its name in a batch file by putting percent signs before and after its name. So, the line

```
B:\WORKING\%SOURCE%
```

will resolve to

```
B:\WORKING\FILES.LST
```

when contained in a batch file.

Since you might have occasion to use % simply as a character, DOS recognizes its doubled form (%%) as representing an actual percent sign.

In summary, we've discussed three types of resolution: a single % followed by a digit is resolved to a parameter from the command line; two single %s enclosing a name are resolved to the value of a variable from the environment; and %% is resolved to %, which then remains in that form with no further resolution.

Of these three types of resolution, only one will apply to any particular occurrence of % in a line. The batch file processor scans the line for percent signs and resolves each occurrence only once. If you used the expression %2 in the previous batch file, it will be replaced with HERE. But if you put %%2 in the file, it will simply become %2 and will stay that way. There may be parameters on the command line, but %%2 has nothing to do with them. That's what the doubling signifies.

You may be wondering why you would want to have the expression %2 remain unresolved. When a batch file is creating a second batch file that contains %2 in one of its commands, this capability becomes crucial. The %2 will be resolved to a parameter when the created batch file is run, since % is no longer doubled. In other words, two successive resolutions can occur, but they have to be in two different batch files.

For example, if you have the expression %%SOURCE%% in the first batch file, it will become %SOURCE% when written to the second batch file. When resolved again, it will finally become FILES .LST. You could also pass the string %SOURCE% as the third command line parameter to a batch file. Any reference to %3 in that batch file will resolve to %SOURCE% and will not be further resolved unless it is sent to another batch file, where it will finally become FILES.LST.

THE SHIFT COMMAND The heart of the loop structure in batch files is the SHIFT instruction, which simply shifts all parameters forward so that what was the value of %2 becomes the value of %1, what was %3 becomes %2, and so on. If there are more than nine parameters, the ones above %9 are not available until shifted into the range of %1 through %9. The tenth parameter cannot be referenced in the batch file at the outset, because the expression %10 is not recognized as such; it would be interpreted as %1 followed by the digit 0, so that if %1 is HERE, %10 would resolve to HERE0; and if %8 is EXE, then %85 will become EXE5. But after a SHIFT, what was the tenth parameter is now the ninth and can be referenced as %9; similarly, the original 11th parameter will be %9 after a second SHIFT, and so on.

Most of the literature dealing with the SHIFT command cites only that SHIFT makes it possible to deal with more than nine parameters. This is true, but beside the point. The most important property of SHIFT is that you can use it to shift *any* list of parameters, not necessarily a list of more than nine parameters. This means multiple arguments can be processed in a batch file by means of a loop, using the SHIFT command so that each repetition of the loop will process the next parameter.

This is the easy way to implement a process that needs to be performed on a series of arguments, one after another. The essence of such a batch file is that the same processing applies to every parameter. Creating the same effect without SHIFT and a loop would be confusing and messy. You can also use the SHIFT command when you have to do the same thing with each parameter, and the number of parameters can be different each time the batch file is invoked. It doesn't necessarily have to be a large number.

Thus, if you want to copy some files from your hard disk to a diskette now and then, and the files are different ones each time, you might want a batch file like this:

```
:LOOP
COPY %1 A:
SHIFT
IF NOT (%1)==() GOTO LOOP
```

We'll go into detail about the IF syntax later, but you can already guess what this batch file does. It copies all the files whose names you enter on the command line when you invoke it to the A: drive. Assume you call this batch file CTD.BAT (meaning Copy To Diskette) and execute the following command:

```
CTD A.EXE B.COM C.ASM
```

When execution begins, the first replaceable parameter, %1, is A.EXE. Thus, the COPY command on its first execution will become

```
COPY A.EXE A:
```

and will copy the file A.EXE to your disk in drive A:. When the SHIFT command is executed, B.COM becomes %1 (and C.ASM becomes %2). The IF command tells DOS to go back to the label :LOOP since %1 still has a value. COPY is executed again, and this time it becomes

```
COPY B.COM A:
```

which copies the second file. Again, the SHIFT command is performed, and %1 becomes C.ASM. The GOTO command returns us to COPY, and the last file is copied. SHIFT, executed a third time, causes %1 to have no value. This is because its value is now that of the original fourth parameter—and there was none. The conditional test by IF now fails, so GOTO is not performed and DOS completes the processing of the batch file.

With this batch file, you can type CTD followed by as many filenames as you can fit on the command line. Whether or not it's more than nine is of no importance at all. Note that %1 is the only parameter reference used. There is no need to use any other numbers, because every parameter will be %1 when its turn comes. This is the essence of the logic involved with SHIFT: the action of the batch file is independent of the number of parameters. Figure 2 shows what you see on the screen when this batch file runs.

THE IF STATEMENT The IF statement in batch files is similar to its BASIC counterpart, but more restricted. In our example, it compares two character-strings and, if they are equal, executes a command (in this case, GOTO). The equals sign is doubled (==) in an IF statement, because the single equals sign (=) is interpreted by DOS as a delimiter, like a space or a comma. Thus, the command

```
IF ABC==ABC DIR
```

will do a directory (DIR) since the two strings, ABC and ABC, are obviously identical. The command

```
IF ABC==XYZ DIR
```

will do nothing, since the strings are different. The word NOT can be inserted after the word IF to reverse the condition as follows:

```
IF NOT ABC==ABC DIR
```

will do nothing, but

```
IF NOT ABC==XYZ DIR
```

will do a DIR.

```
C>COPY A.EXE A:
1 File(s) copied

C>SHIFT

C>IF NOT (B.COM)==() GOTO LOOP

C>COPY B.COM A:
1 File(s) copied

C>SHIFT

C>IF NOT (C.ASM)==() GOTO LOOP

C>COPY C.ASM A:
1 File(s) copied

C>SHIFT

C>IF NOT ()==() GOTO LOOP
```

Figure 2: *An example of an interactive session using the SHIFT command.*

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PC HANDS ON

BY BILL O'BRIEN

Field-leading 386 performance just got cheaper. Northgate Computer Systems' Power 386 rivals the power of the Compaq Deskpro 386/20 at a fraction of the cost.

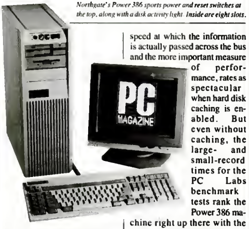
The Power 386 is an upright, 20-MHz floor model with a base price of $4,295—including a high-performance 65MB hard disk.

A 64K static RAM memory cache deserves much of the credit for the Power 386's performance. Like the Deskpro 386/20, the Power 386 maintains a high-speed, 32-bit path to memory, separate from the I/O bus.

Whereas the 386/20 makes use of Intel's sophisticated cache controller chip, however, the Power 386 falls back on a direct-map static RAM system composed of discrete logic components. Compaq's solution no doubt earns it memory access performance gains in some cases, but the Power 386 won't be far behind.

The hard disk drive does not have an overly spectacular track-to-track access time—28 milliseconds—but that is a mechanical measurement of disk capability. Data throughput, the speed at which the information is actually passed across the bus and the more important measure of performance, rates as spectacular when hard disk caching is enabled. But even without caching, the large- and small-record times for the PC Labs benchmark tests rank the Power 386 machine right up there with the Compaq Deskpro 386/20.

Northgate's Power 386 sports power and reset switches at the top, along with a disk activity light. Inside are eight slots.



The standard configuration includes a 14-inch monochrome monitor, one 5¼-inch 1.2MB floppy disk drive, and one 3½-inch 1.44MB floppy drive. That leaves you with one empty half-height bay.

Whether you purchase this 386-based machine for its price tag or for its performance, the chances are that you won't be disappointed. Watch *Microsoft Windows* load quickly for a change, or observe a pull-down menu snap up like a runaway window shade, and you will finally get an honest feel of what speed is all about. PC

PC FACT FILE

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13895 Industrial Park Blvd.,
#110
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List Price: With 1MB DRAM, 64K SRAM cache, one 5¼-inch 1.2MB floppy disk drive, one 3½-inch 1.44MB floppy disk drive, 65MB hard disk, monochrome monitor, $4,295.
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Of course, you wouldn't use the IF statement for these commands. If you wanted to do a DIR, you would just type DIR. But the value of IF lies in its ability to test the value of a command line parameter. For example,

```
IF %7==ABC TYPE FILES.LOG
```

will type the file FILES.LOG only if the value of the seventh parameter is ABC. Similarly, environment variables can be tested for content. The one-line statement

```
IF NOT %WORK%==A:\PAS COPY
  \SAMPLE.TXT
```

will copy the file SAMPLE.TXT from the root directory to the current directory, unless A:\PAS is the value represented by the name WORK in the environment.

A parameter that wasn't entered on the command line or that isn't in the environment evaluates to a null string. A null string consists of no characters, is equal to another null string, and is unequal to any string that isn't null. However, a command such as

```
IF %4==   GOTO NEXT
```

should be avoided and may cause an error message and unpredictable results. When testing a parameter for a null value, I always enclose the reference to it in parentheses. These are not recognized as delimiters or as having any meaning by DOS and are simply treated as part of the string. So the condition

```
(%5)==()
```

is true if %5 has no value at present, and false otherwise.

Now you can see how the IF statement worked in our batch file above. Its action is "go back to LOOP if the current value of %1 is not null (%1 has a value)." %1 has a value until all three files have been copied. Then, after the third SHIFT, it no longer has a value and the condition becomes false.

A conditional comparison such as

```
(%3)==(%SIZE%)
```

would compare the third parameter on the command line with the value of the name SIZE in the environment. If they're both null (%3 has no value at present and there's nothing called SIZE in the environment), then they are equal and the condition is true. If one exists and the other doesn't, then they're unequal. And of course, if they both exist, they may or may not be equal.

When you use IF to test the value of a parameter, even if a null value is not what you're checking for, you should still use the parentheses if there's any possibility that the parameter might in fact be null. A statement like

```
IF %4==REPEAT GOTO LOOP
```

is fine if you know for sure that %4 will have some value, but may cause an error if it has no value (and that can happen as the result of SHIFTing). The same caution applies to environment variables. Remember that any time you use parentheses, you must use them on both sides of the doubled equals sign (==). If you use them on only one side, the strings will *never* match, because the parentheses are just part of the string as far as DOS knows.

MAKING IT WORK Now we'll create a more complex batch file that shows different parameters and illustrates how to use the environment as a way to keep track of a value.

Suppose we want to modify the batch file we wrote before so that it will copy the list of files to a diskette in a drive we specify when we run it. It seems natural to type A or B as the first parameter and let the list of files begin with the second parameter. So we might rewrite the CTD.BAT file as follows:

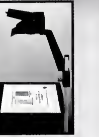
```
:LOOP
COPY %2 %1:
SHIFT
IF NOT (%2)==() GOTO LOOP
```

and execute the command

```
CTD B A.EXE B.COM C.ASM
```

The first file to be copied is now %2; the drive letter is %1. So the COPY command works the way we expect it to the first time through the loop. (Note that the batch file includes the required colon after %1 so that DOS will recognize it as a drive letter.)

When the SHIFT command is executed, it causes B.COM to become %2, and



IF sends us back to the COPY command. The batch file will work fine as far as the shifting and looping logic is concerned, but this isn't enough. The batch file as it is now will not work.

To see why, let's go back to the first pass through the loop. Assume we've just copied A.EXE and then shifted all parameters forward. B.COM is now %2, but %1 is no longer the drive letter B. Instead, it's now A.EXE! A parameter is a parameter and DOS isn't going to shift just some of them and leave others alone. On the second pass, the COPY command will resolve to

```
COPY B.COM A.EXE:
```

which will cause an error message because of the colon. Without the colon, it would copy B.COM over A.EXE, erasing the original A.EXE. This is the kind of mess you can get into by not implementing batch files carefully.

The environment can be used inside a batch file to overcome some of these problems. For example, consider the following improved version of CTD.BAT:

```
SET DRIVE=%1:
:LOOP
COPY %2 %DRIVE%
SHIFT
IF NOT (%2)==() GOTO LOOP
SET DRIVE=
```

This batch file will do what we want. Note that neither occurrence of the SET command is inside the loop. They are each executed only once. At the very beginning, SET creates a variable called DRIVE in the environment and assigns it a value identical with that of %1, followed by a colon. %1 is B when CTD is invoked, so DRIVE will be B: and the COPY command will resolve to

```
COPY A.EXE B:
```

The SHIFT and IF commands will do just what they did before. But the loop returns to the COPY command, not the SET command. The second loop resolves to

```
COPY B.COM B:
```

This is because %2 is now B.COM and DRIVE is in the environment with the value B:. Yes, %1 is now A.EXE, but that doesn't matter. The COPY command

doesn't use the parameter %1. It's just looking at the value of DRIVE in the environment, and that's still B: since we haven't changed it. DOS can do what it likes with %1, and our batch file will still work. We have used an environment variable as a way of saving a value.

A batch file should always "clean up" after itself. We created a variable in the environment while running the batch file. When execution is completed, we get rid of it with the final SET command, which removes the name DRIVE from the environment. (When entering such a command, you must press the Enter key immediately after the equals sign. Don't leave a space.)

Note that this SET command, like the first one, is outside the loop. It is not reached until after the last pass, when %2 is found to be null and we escape from the loop. If your batch files don't do this, your environment will soon become cluttered with variables that are no longer needed and should have been removed. This is not the best programming practice. Similarly, a batch file that creates temporary files on your disk, just for its own purposes, should always erase them afterwards.

THE FOR STATEMENT Although it is listed under "Batch Commands" in the DOS manual, FOR can also be used on the command line. The logic of the FOR command, which creates a sort of "loop" within itself, is determined by the regular command line processor that interprets all commands, whether or not they come from batch files. The double percent sign (%%) is used in this command when a batch file is involved, but that has to do with the "resolution" of two percent signs to one, rather than with the syntax of the FOR statement itself.

Let's put batch files aside and assume we're typing on the command line. References to environment variables like %SIZE% are not permitted, and references to replaceable parameters like %3 are obviously not applicable. If we use a percent sign on the command line, it will either be in a FOR command, where it has a special meaning, or else it will just be a character in a string (perhaps in a SET, FIND, or ECHO statement).

But whenever a percent sign is used on the command line, in a FOR statement or otherwise, it is always a single %; %% is for batch files only. So all three special kinds of "resolution" that occur involving percent signs—the double-to-single, the environment variable, and the replaceable parameter—occur only in batch files. On the DOS command line, none of these expressions is resolved in any way; %% remains as %% and %SIZE% or %3 similarly remains unchanged. But there is a fourth kind of resolution that occurs, namely the resolution of percent signs as used in the FOR command.

The FOR command takes its own parameters. When the command line processor is scanning a FOR statement, it will expect to find a single percent sign (%) used in any reference to the parameters of the statement. If you use FOR in a batch file, you must put in %% so that it will resolve to % within the batch file itself before being passed to the command line processor. The double percent is required by the syntax of batch files—not by that of the FOR command itself.

The FOR command executes a command repeatedly, once "FOR" each item on the list of parameters you type as a part of the command itself. This is another way of doing something repeatedly, just as our CTD.BAT file did. Here is a FOR command that you could type on a single line to copy three files to a diskette:

```
FOR %F IN (A.EXE B.COM C.ASM)
  DO COPY %F A:
```

This command will do exactly what the batch file CTD.BAT did before. The parameters are represented by a percent sign followed by a single letter. Since they're files in this example, I chose %F, but you can use any letter. The list of parameters must be enclosed in parentheses and separated by delimiters. The word DO is followed by any *one* command that's to be executed once for each parameter in the list. So, in the command COPY %F A:, the %F first resolves to A.EXE, giving

```
COPY A.EXE A:
```

Then the %F is resolved to B.COM and C.ASM in turn, giving the same results that we got with our batch file.

Suppose you have five subdirectories called A, B, C, D, and E, and you want to copy all of their contents to a diskette. Consider the following one line command:

```
FOR %D IN (A B C D E) DO COPY
  \%D\*.* A:
```

If you wanted to use this FOR command as part of a batch file, it would become

```
FOR %%D IN (A B C D E) DO COPY
  \%%D\*.* A:
```

which differs only in that each % is now doubled. When you run the batch file, each %%D will become %D and the command will then be in the proper form to be interpreted.

To add versatility, you can use wildcards in the parameter list. For example,

```
FOR %F IN (*.OBJ *.BAK) DO DEL %F
```

would erase all files from the current directory with the extensions .OBJ and .BAK. There is, however, a hidden danger lurking for unsuspecting users of this command. Suppose you want to erase the files with those extensions in a directory called TEMP, which is not the current directory. You might try to do it with this line:

```
FOR %F IN (*.OBJ *.BAK) DO DEL
  \TMP\%F
```

It would be logical to assume that the DEL command will resolve to DEL \TMP*.ASM, and so on. But it won't! This results from a special feature built into the FOR syntax, making it more versatile and dangerous. When any filenames containing wildcards are encountered in a FOR parameter list, the replacement of such a name by each file that matches it is done as part of the FOR resolution. If there are 10 files matching each wildcard, for a total of 20 files, the DEL command will be resolved *not* into 2 commands with wildcards, but into 20 commands with the individual filenames!

But the list of filenames is wrong. When DOS was making the list, it hadn't looked yet at the DEL command and didn't know that you were interested in directory \TMP. It made a list of all the files it found

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with those extensions in the current directory. If no files in the two directories match, the FOR command does nothing. The most that can happen is that it will delete any files in directory \TMP that happen to have the same names as those it found in the current directory. However, this can be a disaster.

To use a FOR command with specified directories (or drive letters), use a one line command such as the following:

```
FOR %F IN (\TMP\*.OBJ \TMP\*.BAK)
 DO DEL %F
```

The path is specified together with each filespec and will be treated as part of it when the list of filenames is made. Note also that once a path is added to a filespec, it becomes attached to it and remains there, so you must not repeat the path afterwards.

USING FOR IN BATCH FILES When FOR is used in a batch file, the argument in the parameter list can reference the batch file's command line parameters. These will be resolved by the batch processor in the usual way. Assume you have an editor that you want to put temporarily into a "working" directory along with the data file being edited. When you're finished, you want to copy the newly edited file to a subdirectory called \RECORDS, save the old version on a diskette, and then empty the working directory. To simplify things, you want a batch file to do the work for you. But you don't always use the same editor, so all three filenames will vary and must be given to the batch file as parameters.

To edit CONFIG.SYS using an editor called ED.EXE, which creates backups with a .BAK extension, you might use the following single-line command:

```
CLEANUP ED.EXE CONFIG.SYS
 CONFIG.BAK
```

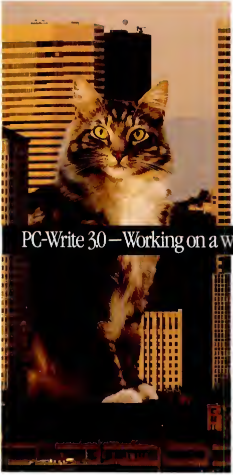
Here's how the batch file might look using the FOR statement:

```
COPY %2 \RECORDS
COPY %3 A:
FOR %%F IN (%1 %2 %3) DO DEL %%F
```

The single percent signs will resolve to their command line values, and the double percents will resolve to single ones. The third line will become

```
FOR %F IN (ED.EXE CONFIG.SYS
 CONFIG.BAK) DO DEL %F
```

The line will be passed, in that form, to the regular command line processor—which is the same place it would go if you had typed in the command at the DOS



prompt. Of course, the commands

```
DEL %1
DEL %2
DEL %3
```

might be simpler than using the FOR statement. But when you have more than a few items, the FOR statement can be used to good advantage.

Just as replaceable parameters can be used to specify multiple arguments, environment variables may be used as well. Moreover, the value of such a variable can contain spaces or other delimiters, so a whole FOR-parameter list can be a single variable. Earlier, we used the single-line command

```
FOR %D IN (A B C D E) DO COPY
 \%D\*.* A:
```

to copy the entire contents of five directories to a diskette. Now suppose that frequently you want to add one or two extra directories to the list just for one operation. Alternatively, you might want to leave out one or two of the regular entries. You could accomplish this with a batch file that contains the following one-line command:

```
FOR %%D IN (%DIRS%) DO COPY
 \%%D\*.* A:
```

When this is preceded by the command

```
SET DIRS=A B C D E
```

in your AUTOEXEC.BAT file, the variable DIRS will be resolved when you execute the batch file. This will result in the command

```
FOR %D IN (A B C D E) DO COPY
 \%D\*.* A:
```

This, of course, is what you wanted. (Note the use of the double percent sign in the %%D argument.) Later, if you want to back up a slightly different set of directories, simply type

```
SET DIRS=A B C E J N
```

at the command line before calling the batch file. The FOR command hasn't changed, but the value of the environment variable DIRS has changed. The result is a new command. After all, why type out the entire FOR command each time? It's much better to let environments and batch files do all the work for you.

There is one point you must be careful about, however. It's easy—but incorrect—to think that whenever an environment variable consisting of several discrete parts is used in a batch file, DOS will always separate the parts and use them one at a time. This type of expansion is performed only in the FOR command and then only because such a variable, once resolved, looks like a parameter list.

Once an environment variable is resolved in the FOR command, the spaces or commas (or semicolons, as in the PATH variable) embedded in the string will act as delimiters. But there are no delimiters in the environment itself. The value of an environment variable is always a single value, and the spaces and punctuation marks are just parts of it. Every occurrence of the name in a batch file will resolve to the complete value—spaces and all.

A multiple-entry environment variable may also be built up one item at a time by a loop. The loop could be an actual GOTO statement in a batch file, or it could be an implied loop in a FOR statement (which is, in effect, a one-line loop). Let's assume you want to put a list of filename extensions in the environment, however, you want only those extensions that are in use in the current directory. It's a simple operation. Just create a batch file called EXTLIST.BAT that contains the following commands:

```
SET EXT=
:LOOP
IF EXIST *.%1 SET EXT=%EXT% %1
SHIFT
IF NOT (%1)==() GOTO LOOP
```

The IF EXIST command simply tests whether a given file can be found in the specified directory. In the case of wildcards, any file that matches the file specification will make the IF EXIST condition true. (You can also perform a test to see if the file doesn't exist using IF NOT EXIST.)

At this time, if we issue the single-line command

```
EXTLIST PAS BAT C ASM TXT
 BIN OBJ SYS
```

we can test to see which of these extensions are in use. The batch file begins by getting rid of any old value of the variable EXT by setting it equal to an empty string. Since PAS is the first parameter on the command line, the first pass through the IF statement will resolve to

```
IF EXIST *.PAS SET EXT= PAS
```

The SET command will be executed only if there is at least one file with the extension .PAS in the current directory. On the second pass, we test for files with the extension .BAT. The IF command looks like this:

```
IF EXIST *.BAT SET EXT= PAS BAT
```

The reference %EXT% now is resolved to PAS, because that is the current value of the variable. If any .BAT files are found, the SET command will modify EXT to PAS BAT.

This process will continue until all the parameters on the command line have been evaluated. Each time the SET command is executed, it will retrieve the current value of EXT, add a new item to it, and make that the new value.

But of what practical use is this kind of multiple-argument variable? One idea might be to design a batch file to perform a selective backup by copying all files in the current directory whose extensions match any of those in the EXT list currently in the environment. A file with the command

```
FOR %%E IN (%EXT%) DO COPY *.%%E A:
```

would do the trick. If the current list of extensions is .PAS, .TXT, .BIN, and .SYS, this will resolve to the line

```
FOR %E IN ( PAS TXT BIN SYS)
 DO COPY *.%E A:
```

and the COPY command will be executed four times.

You may notice that the value of EXT in the environment always begins with a space. This is because, when starting to build the list, EXT is null and the command SET EXT=%EXT% %1 resolves to SET EXT= PAS, with a space immediately after the equals sign. When a new item is added to the current value of EXT, it must have a space to act as a delimiter between itself and the preceding item. On the first pass, there's no text before the space, but the space itself is still there.

GENERATING LISTS Let's see how one of these lists in the environment can be created by a FOR statement, without any actual loop in a batch file. Some of these examples use the batch-file command CALL, which didn't become available until DOS 3.3. If you're using an earlier version, you'll need to upgrade in order to take advantage of these batch file techniques.

To put in the environment a list of the complete names of all files in the current directory that match any of one or more given filespecs, create a batch file called LIST.BAT that contains the single line

```
SET FILES=%FILES% %1
```

To create a list of all the .ASM, .BAS, and .PAS files, you would execute the following one-line command:

```
FOR %F IN (*.ASM *.BAS *.PAS)
 DO CALL LIST %F
```

The command CALL executes the batch file LIST.BAT from the FOR statement. If you were to invoke the batch file directly, by simply listing its name without the word CALL, the FOR command would be left unfinished. This is because DOS will stop as soon as it comes to the end of a batch file. It doesn't "remember" that it was in the middle of a FOR statement unless you use CALL. This also applies to calling one batch file from another.

The CALL command will be performed once for each .ASM, .BAS, and .PAS file. If there are ten of each, 30 CALLs will be made. Each time the file LIST.BAT is called, the value of %1 (the filename passed to it) will be added to the environment variable FILES. Remember that if the variable FILES already exists, you must clear the list by typing

```
SET FILES=
```

before you "build" a new list by this method.

As before, the list may be used in any FOR statement. For example, the single-line command

```
FOR %%F IN (%FILES%) DO COPY
 %%F PRN
```

would send all the files whose names are on the list to your printer. Remember a FOR statement that uses one of these lists from the environment must be in a batch file, since references like %FILES% are not permitted on the command line. It's a pity.

But typing the long FOR command seems like too much work. Can the FOR statement be in the batch file? Suppose you want to get the same results as in the last example just by typing LIST ASM BAS PAS. You might make a batch file that contains the line

```
FOR %%F IN (*.%1 *.%2 *.%3)
 DO SET FILES=%FILES% %%F
```

While this command looks OK, it will not work. The resolutions simply don't take place in the correct order. %1 and so on will resolve to parameters, %FILES% reference will resolve to the current value of the variable, and the double %%F resolves to a single %F. Assuming that you have cleared the list before calling the batch file, the resulting command line would be

```
FOR %F IN (*.ASM *.BAS *.PAS)
 DO SET FILES= %F
```

The environment reference %FILES% was resolved to nothing since the list starts out empty. The command line is then passed to the command processor, where %F will be successively set equal to the name of each file. But now the SET command simply sets FILES equal to the name of each file found, one at a time. When it is complete, FILES will simply contain the name of the last file found. This is because the reference %FILES% is no longer there!

Of course, if you're determined to force that reference into the resolved command line, you can use double percent signs that will resolve to single percent signs. In other words, use the single line

```
FOR %%F IN (*.%1 *.%2 *.%3)
 DO SET FILES=%%FILES%% %%F
```

as your batch file. This will ultimately resolve to the line

```
FOR %F IN (*.ASM *.BAS *.PAS)
 DO SET FILES=%FILES% %F
```

Aha! "Now," you say, "I've got it licked." No, you haven't. It still won't work, because now the reference %FILES% won't resolve at all. The resolved statement is passed from the batch file to the command processor, and then the FOR list references are resolved, but nothing else is resolved. References to the environment are resolved only in batch files, and by the time the FOR "loop" processing begins the statement is no longer in the batch file.

So, there would seem to be no method to avoid having to type the whole FOR statement every time you want to generate a list. There is a way, but you need two batch files to do it. You would execute the first one (LIST.BAT) and it, in turn, would invoke the other (which we'll call BUILD.BAT). LIST.BAT would contain the single-line command

```
FOR %%F IN (*.%1 *.%2 *.%3)
 DO CALL BUILD %%F
```

and BUILD.BAT would contain the single command

```
SET FILES=%FILES% %1
```

Executing the command

```
LIST ASM BAS PAS
```

will resolve to the single line

```
FOR %F IN (*.ASM *.BAS *.PAS)
 DO CALL BUILD %F
```

and CALL is performed once for each file, calling BUILD.BAT with one filename as a parameter, and BUILD.BAT adds that filename to the list. But, of course, this version of LIST.BAT allows only three filespecs. A more versatile form would be a file that contained (on a single line) the command

```
FOR %%F IN (*.%1 *.%2 *.%3 *.%4
 *.%5 *.%6 *.%7 *.%8 *.%9)
 DO CALL BUILD %%F
```

This would allow up to nine file types, which will usually be enough. If you need an unlimited number, all you have to do is put a loop in LIST.BAT with the following commands:

```
SET FILES=
:LOOP
FOR %%F IN (*.%1) DO CALL BUILD %%F
SHIFT
IF NOT (%1)==() GOTO LOOP
```

In fact, I think that this version is better. When you're working with a fixed number of parameters, leaving some of them unused in the original LIST.BAT can result in a command such as

```
FOR %F IN (*.ASM *. *. *. *.
 *. *. *. *.) DO CALL BUILD %F
```

which could produce unexpected results. Alternatively, you could change the FOR statement to read

```
FOR %%F IN (%1 %2 %3 %4 %5 %6 %7
 %8 %9) DO CALL BUILD %%F
```

and type complete filespecs on the command line, with wildcards in the name, in the extension, or wherever you please. This form gives more flexibility but also requires more typing. To make the loop version of LIST.BAT work in the same manner, change (*.%1) to (%1) in the FOR statement.

I prefer the loop version, because it releases you from the responsibility of having to "clear" the list before building a new one. Not only is it an extra line to type, but it's too easy to forget. So what if the batch file is longer. You only have to type the batch file once!

Finally, if you ever wanted to put your entire current directory into an environment list, you would use

```
FOR %F IN (*.*) DO CALL BUILD %F
```

which could be generated by typing LIST *.* if your LIST.BAT expects complete filespecs, or just LIST * if it expects extensions alone.

We've reviewed the batch command language, replaceable parameters, and the versatility of the FOR statement. By using environment variables in batch files, we've saved typing and increased efficiency. We've also noted some problems that can pop up when using parameters that are resolved by the batch processor. But these tips just scratch the surface of batch file power. Use them as a starting point to develop your own techniques and become a batch file power user!

Norman Hale is a free-lance writer and computer hobbyist.

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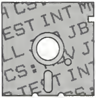

The amount of memory you can allocate to an expanded memory RAMdisk often varies with the application you're running. XPANDISK lets you resize your RAMdisk without rebooting.

If you've been hit with an "out of memory" message when trying to load a large text file, database, or spreadsheet, you're probably already acquainted with the add-in memory boards that embody the Lotus/Intel/Microsoft (LIM) expanded memory specification. Applications written to take advantage of the LIM specification can access up to 32MB of expanded memory.

In addition to providing a bridge across the conventional 640K DOS memory barrier, expanded memory boards invariably supply the software you need to devote part of their resources to the creation of a virtual (or RAM) disk. The XPANDISK.SYS and XPANBOSS.COM utilities presented here will help you make the best use of that RAMdisk.

As far as DOS is concerned, a virtual disk is logically indistinguishable from a formatted floppy or hard disk. You use the same COPY, DEL, DIR, CHKDSK, and other DOS commands (with a few exceptions) you would use with a physical disk. But since RAMdisks exist only in memory, they require no time-wasting disk head movement. Moving files to and from a RAMdisk is essentially instantaneous.

The biggest disadvantage of a RAMdisk is its volatility. When you turn off your machine (or get a power-line blip), the contents of a RAMdisk are lost unless you have also saved them on regular magnetic media. For that reason alone, using RAMdisks for data storage is not recommended.

RAM drives are wonderful, however, for storing a copy of your program files. Loading a program that is to be run from a RAMdisk is immediate. All you have to do is copy the program files you regularly expect to use from a physical disk to the RAMdisk (usually in your AUTOEXEC.BAT file) when you boot up. From then until you shut down, any of these programs can be instantly loaded from RAM. RAM drives are also perfect for storing temporary files, such as the intermediate files created in compiling source code. Besides being faster, using memory for temporary files saves unnecessary wear and tear on physical disks.

XPANDISK.SYS and XPANBOSS.COM address the second problem with RAMdisks. With all virtual disk drives the amount of memory you allocate to the drive must be set at boot time and cannot be changed during the session without rebooting the system. A large RAMdisk is needed to store large program files, but a large disk dips into the expanded memory pool needed to run those same programs. When push comes to shove, you are usually forced to give up the RAMdisk or configure it to so small a size as to make it useless.

■ To get the maximum utility out of your expanded memory investment, you need a RAMdisk that you can shrink or expand.

What you really need is a RAMdisk you can shrink before using a memory glutton such as a huge spreadsheet. You also need a RAMdisk you can expand when you leave that task and switch to an editing and compiling session, so it can store the program and the temporary files it creates. This is the way to get the maximum utility out of your expanded memory investment.

XPANDISK.SYS is an expanded memory disk device driver that, under the control of its companion program, XPANBOSS.COM, can do just that. It gives you the ability to change the size of XPANDISK at any time.

GETTING XPANDISK You can download both XPANDISK.SYS and XPANBOSS.COM from PC MagNet, as explained in the sidebar "XPANDISK by Modem." The assembly language listings for both programs are listed here and are also available on PC MagNet, as are BASIC programs that will create the .SYS and .COM files when run once in BASIC.

While the device driver name will vary slightly, depending on which manufacturer's expanded memory board you have, the statement

```
DEVICE=EMM.SYS
```

must appear in your CONFIG.SYS file *before* you add the statement that loads

XPANDISK. Except for this restriction, XPANDISK.SYS is installed like any other device driver—by adding a device statement to your CONFIG.SYS file. The syntax for XPANDISK is

```
DEVICE=[path]XPANDISK.SYS [/D][/S][/E][/M][/A]
```

entered on a single line. (Don't forget the .SYS extension. Unlike the DOS command line, which will search for executable programs if you omit the extension, without the .SYS extension XPANDISK will not be found and, therefore, not be installed.) Use the prefacing path option if you choose to store the driver somewhere else so as not to clutter up the root directory. If none of the optional parameters is supplied, XPANDISK defaults to a 64K drive with a sector size of 256 bytes and room for 64 root directory entries.

To change the disk size, add the /D switch, followed by a disk size between the minimum of 16K and a maximum of 32,768K. A page (16K) is the smallest amount of expanded memory that can be allocated, and 32,768K (32MB) is the maximum that can be managed by the LIM 4.0 Expanded Memory Manager. The requested disk size will be rounded up to a multiple of the 16K page allotments. If the request is greater than the available memory, the virtual disk will be installed to the maximum available. The disk size includes the boot sector, FAT, and root directory so the actual room for data will be slightly less than requested.

DOS allocates disk space for files in collections of sectors known as clusters. A cluster is the smallest unit of disk space that can be used for files. Since disk head movement is not a factor here, XPANDISK uses a single sector per cluster. This means that the cluster size determines the economy of the disk. The sector size, specified by the /S switch, may be 128, 256, or 512 bytes. Use a smaller sector size if you have a lot of small files; otherwise, use the largest sector size, as this will require fewer sector accesses for reads and writes and will result in slightly faster performance.

For very large disks, XPANDISK will increase the sector size to conform to the maximum of 65,535 clusters on a disk. Because of this total cluster restriction (which is one less than the actual number of sectors necessary for a 32MB disk), XPANDISK must use two sectors per cluster for RAMdisks larger than 16MB.

The /E parameter sets the number of entries available in XPANDISK's root directory. Acceptable values are between 4 and 512, and each directory entry consumes 32 bytes of disk space. XPANDISK will automatically round up the requested directory entries to the nearest sector boundary. Choose a file limit that will best utilize the directory structure you plan to use. For example, if the root will contain only a few subdirectories or files with most of the files maintained in subdirectories—the recommended structure—reduce the number of root directory entries. On the other hand, if you will be keeping a lot of files in the root, increase the entry number to avoid the ambiguous DOS File Creation Error message caused by a full root directory. Note that if XPANDISK is given a volume label, this will use one of the available root directory entries.

■ The /M parameter automatically minimizes the disk size to 16K. Use it to shrink the disk and release the rest of its expanded memory to those big applications.

The /M parameter automatically minimizes the disk size to 16K. You use this option to shrink the disk and release the rest of its expanded memory to those big applications. The /A parameter does just the opposite of /M, claiming all available expanded memory for the drive.

Although it must not be confused with DOS's VDISK program (which uses conventional and extended, but not expanded, memory), XPANDISK will accept command-line comments comparable to those you use with VDISK.

For example, to remind you of the meaning of the parameters, your CONFIG.SYS file might have (on a single line)

```
DEVICE=XPANDISK.SYS /disk size = 120K
 /sector size = 128 bytes
```

This would be the equivalent of the abbreviated

```
DEVICE=XPANDISK.SYS /D120/S128
```

Note that the /D and /S parameters (which need not be capitalized), followed by a numeric value, are all that XPANDISK is interested in. Everything else, including K after 128, is ignored. Assuming the memory is available, the above command would create a disk of 128K (120K rounded up to a multiple of 16K), with a sector size of 128 bytes and the default of 64 entries in the root directory.

The drive letter DOS assigns to XPANDISK will be the first available when it is installed. If you are currently using a SUBST drive, make sure it does not conflict with XPANDISK's added drive letter. You can install more than one XPANDISK drive just by adding another DEVICE=XPANDISK.SYS statement to the CONFIG.SYS file. Each driver consumes approximately 1,200 bytes of conventional memory. XPANDISK will work with EMM 3.0 and DOS 2.0 and later.

USING XPANBOSS XPANBOSS is a regular .COM file that uses the DOS I/O control service to communicate with XPANDISK. With XPANBOSS you can change the configuration of the XPANDISK virtual drive any time you're at the DOS prompt. The syntax for XPANBOSS (which must be entered on a single line) is

```
XPANBOSS [d:][/D disk size][/S sector size]
 [/E entries][/W][/R][/M][/A]
```

As you'll observe, most of the disk parameters are exactly the same as those for XPANDISK and, again, explanatory words such as "entries" are optional. One new item that XPANBOSS needs to know is which drive you wish to configure. If you omit the drive argument, the default drive is assumed. But more often than not the target drive is not the current default, so you will want to include the drive letter. You cannot alter a drive that was not installed by XPANDISK, however, so don't worry about accidentally modifying your regular hard disk. XPANBOSS will let

```
;  XpanDisk is a virtual disk device driver for expanded memory.
;  The driver has the capability of releasing memory allocated to
;  its drive, making it available to other applications.  All data
;  is lost if the drive is resized.  XPANDOSE.COM is the control
;  program for the XPANDISK.SYS driver. PC Magazine 10-31-88

_TEXT           SEGMENT PUBLIC 'CODE'
                ASSUME  CS:_TEXT,DS:_TEXT
                ASSUME  ES:_TEXT,SS:_TEXT
                ORG     0H

;************* DEVICE_HEADER *************;

POINTER         DD      -1                      ;Minus one indicates one driver.
ATTRIBUTE       DW      0100000000000000B       ;Block device with IOCTL support.
DEVICE_STAG     DW      STRATEGY                ;Pointer to strategy procedure.
DEVICE_INT      DW      INTERRUPT               ;Pointer to interrupt procedure.
DEVICE_NAME     DB      1, 7 DUP (?)            ;One unit.

REQUEST_HEADER          STRUC
 HEADER_LENGTH           DB      ?
 UNIT_CODE               DB      ?
 COMMAND_CODE            DW      ?
 STATUS                  DW      ?
 RESERVED                DQ      ?
REQUEST_HEADER          ENDS

INIT_PACKET             STRUC
 INIT_HEADER             DB      (TYPE REQUEST_HEADER) DUP(?)
 UNITS                   DW      ?
 ENDING_OFFSET           DW      ?
 ENDING_SEGMENT          DW      ?
 ARGUMENTS_OR_ARRAY_OFF  DW      ?
 ARGUMENTS_OR_ARRAY_SEG  DW      ?
INIT_PACKET     ENDS

MEDIA_CHECK_PACKET      STRUC
 MEDIA_CHECK_HEADER      DB      (TYPE REQUEST_HEADER) DUP(?)
 CHECK_MEDIA_DESCRIPTOR  DW      ?
 RETURN_BYTE             DB      ?
MEDIA_CHECK_PACKET      ENDS

BUILD_BPB_PACKET        STRUC
 BUILD_BPB_HEADER        DB      (TYPE REQUEST_HEADER) DUP(?)
 BPB_MEDIA_DESCRIPTOR    DB      ?
 BPB_TRANSFER_ADDRESS    DD      ?
 BPB_OFFSET              DW      ?
 BPB_SEGMENT             DW      ?
BUILD_BPB_PACKET        ENDS

INPUT_OUTPUT_PACKET     STRUC
 INPUT_OUTPUT_HEADER     DB      (TYPE REQUEST_HEADER) DUP(?)
 IO_MEDIA_DESCRIPTOR     DB      ?
 TRANSFER_OFFSET         DW      ?
 TRANSFER_SEGMENT        DW      ?
 BYTE_OR_SECTOR_COUNT    DW      ?
 STARTING_SECTOR         DW      ?
INPUT_OUTPUT_PACKET     ENDS

CR              EQU     13
LF              EQU     10
CTRL_Z          EQU     26
SPACE           EQU     32
BOX             EQU     254

DONE                EQU     0100H               ;STATUS CODES
WRITE_PROTECT       EQU     8000H
UNKNOWN_UNIT        EQU     8001H
DEVICE_NOT_READY    EQU     8002H
UNKNOWN_COMMAND     EQU     8003H
SECTOR_NOT_FOUND    EQU     8008H

MAX_COMMAND     EQU     12
EMM_FLAG        DB      1
REQUEST_PACKET LABEL    DWORD
REQUEST_OFFSET DW       ?
REQUEST_SEG     DW      ?

;-------------------------------------------------------------------------;
; The only task of the strategy is to save the pointer to the request header. ;
;-------------------------------------------------------------------------;
STRATEGY        PROC    FAR

                MOV     CS:REQUEST_OFFSET,BX    ;Request header address is
                MOV     CS:REQUEST_SEG,ES       ; passed in ES:BX.
                RET

STRATEGY        ENDP

;----------------------------------------------------------------------;
; The interrupt procedure will be called immediately after the strategy. ;
;----------------------------------------------------------------------;
INTERRUPT       PROC    FAR

                PUSH    AX                      ;Responsible for all registers.
                PUSH    BX
                PUSH    CX
                PUSH    DX
                PUSH    DS
                PUSH    ES
                PUSH    SI
                PUSH    DI
                PUSH    BP
                PUSHF

                CLD                             ;All string moves forward.
                PUSH    CS                      ;Point to our data.
                POP     DS

                CMP     EMM_FLAG,1              ;Was EMM found?
                MOV     AX,UNKNOWN_UNIT         ;Assume no.
                JNZ     EXIT                    ;If no expanded manager, exit.

                LES     DI,REQUEST_PACKET       ;Retrieve request header pointer.
                MOV     BL,ES:COMMAND_CODE[DI]  ;Retrieve command.
                CMP     BL,MAX_COMMAND          ;Do we support it?
                MOV     AX,UNKNOWN_COMMAND      ;Assume no.
                JA      EXIT                    ;If out of range, exit.

                XOR     BH,BH                   ;Zero in high half of command.
                SHL     BX,1                    ;Convert to word pointer.
                CALL    DISPATCH_TABLE[BX]      ;Go do our thing.

EXIT:           LDS     DI,REQUEST_PACKET       ;Retrieve request header pointer.
                OR      AX,DONE
                MOV     STATUS[DI],AX           ;Tell DOS we are done.

                POPF                            ;Restore rest of registers.
                POP     BP                      ;Restore registers.
                POP     DI
                POP     SI
                POP     ES
                POP     DS
                POP     DX
                POP     CX
                POP     BX
                POP     AX
                RET                             ;Far return back to DOS.

INTERRUPT       ENDP

EVEN
MIN_RESIDENT    EQU     $

DISPATCH_TABLE LABEL    WORD

DW    INIT,           MEDIA_CHECK,    BUILD_BPB,      IOCTL_INPUT, INPUT
DW    INPUT_NOWAIT,   INPUT_STATUS,   INPUT_FLUSH,    OUTPUT
DW    OUTPUT_VERIFY,  OUTPUT_STATUS,  OUTPUT_FLUSH,   IOCTL_OUTPUT

BOOT_RECORD             LABEL   BYTE

                        DB      3 DUP (0)
                        DB      "XPANDISK"

BIOS_PARAMETER_BLOCK    LABEL   BYTE

BYTES_PER_SECTOR        DW      SECTOR_SIZE_DEFAULT
SECTORS_PER_CLUSTER     DB      1
RESERVED_SECTORS        DW      1
NUMBER_OF_FATS          DB      1
ROOT_DIRECTORY_ENTRIES  DW      ROOT_ENTRIES_DEFAULT
TOTAL_SECTORS           DW      1024 / SECTOR_SIZE_DEFAULT * DISK_SIZE_DEFAULT
MEDIA_DESCRIPTOR_BYTE   DB      MEDIA_DESCRIPTOR
SECTORS_PER_FAT         DW      1
SECTORS_PER_TRACK       DW      8
NUMBER_OF_HEADS         DW      1
HIDDEN_SECTORS          DW      0

BOOT_RECORD_LENGTH      EQU     $ - BOOT_RECORD

MEDIA_DESCRIPTOR        EQU     0FEH
DISK_SIZE_DEFAULT       EQU     64
DISK_SIZE_MINIMUM       EQU     16
DISK_SIZE_MAXIMUM       EQU     32 * 1024
SECTOR_SIZE_DEFAULT     EQU     256
SECTOR_SIZE_MINIMUM     EQU     128
SECTOR_SIZE_MAXIMUM     EQU     512
ROOT_ENTRIES_DEFAULT    EQU     64
ROOT_ENTRIES_MINIMUM    EQU     4
ROOT_ENTRIES_MAXIMUM    EQU     512

DISK_SIZE_TEMP          DW      DISK_SIZE_DEFAULT
SECTOR_SIZE_TEMP        DW      SECTOR_SIZE_DEFAULT
ROOT_ENTRIES_TEMP       DW      ROOT_ENTRIES_DEFAULT
DISK_SIZE               DW      DISK_SIZE_DEFAULT
PARA_FLAG               DB      ?
READ_ONLY_FLAG          DB      0
FORMAT_FLAG             DB      1

BPB_ARRAY       DW      BIOS_PARAMETER_BLOCK

VOLUME_LABEL    LABEL   BYTE
                DB      "PCMAG",SPACE,BOX,SPACE,"MJM"
                DB      08H
                DT      0
                DW      6000H                   ;Date  July 1, 1988
                DW      10E1H                   ;Time  12:00pm
                DB      6 DUP (0)

VOLUME_LENGTH   EQU     $ - VOLUME_LABEL

PASSWORD                DB      "PC Magazine Productivity"
PASSWORD_LENGTH         EQU     $ - PASSWORD

DISK_SIZE_MSG           DB      CR,LF,"Disk Size         ",0
SECTOR_SIZE_MSG         DB  "K",CR,LF,"Sector Size       ",0
DIRECTORY_ENTRIES_MSG   DB      CR,LF,"Directory Entries ",0

MEDIA_NOT_CHANGED       EQU      1
MEDIA_CHANGED           EQU     -1
TWELVE_BIT_FAT          EQU     4087
ONE_K                   EQU     1024
SIXTEEN_K               EQU     16384
THIRTY_TWO_K            EQU     32768

INPUT_COMMAND   EQU     4
COMMAND         DB      ?

FRAME_SEGMENT   DW      ?
HANDLE          DW      ?
PAGES           DW      ?

;--------------------------------------------------------------;
; Character device functions; ignore and return no error code. ;
;--------------------------------------------------------------;
INPUT_NOWAIT:
INPUT_STATUS:
INPUT_FLUSH:
OUTPUT_STATUS:
OUTPUT_FLUSH:   XOR     AX,AX                   ;Successful.
                RET
```

(continues)

XPANDISK.ASM: *The source code for XPANDISK.SYS, the RAMdisk system driver that you install in your CONFIG.SYS file.*

■ UTILITIES

```
;-----------------------------------------------;
; Tell DOS media has changed if disk has been resized. ;
;-----------------------------------------------;
MEDIA_CHECK     PROC    NEAR

                MOV     ES:RETURN_BYTE[DI],MEDIA_NOT_CHANGED
                CMP     FORMAT_FLAG,1
                JNZ     MEDIA_END
                MOV     ES:RETURN_BYTE[DI],MEDIA_CHANGED
MEDIA_END:      XOR     AX,AX
                RET

MEDIA_CHECK     ENDP

;-----------------------------------------------------------;
; When DOS has retrieved BPB, indicate media no longer changed. ;
;-----------------------------------------------------------;
BUILD_BPB       PROC    NEAR

                MOV     ES:BPB_OFFSET[DI],OFFSET BIOS_PARAMETER_BLOCK
                MOV     ES:BPB_SEGMENT[DI],CS
                MOV     FORMAT_FLAG,0
                XOR     AX,AX
                RET

BUILD_BPB       ENDP

;-----------------------------------------------------------;
; Entry point for both DOS INPUT and OUTPUT.  The direction  ;
; the data is moved is determined by INPUT/OUTPUT command code. ;
;-----------------------------------------------------------;
INPUT_OUTPUT    PROC    NEAR

INPUT:
OUTPUT:
OUTPUT_VERIFY:  MOV     AL,ES:COMMAND_CODE[DI]
                MOV     COMMAND,AL              ;Save the DOS request.

;; If you add this code, an asterisk will be
;; displayed so you can observe every disk access.
;;  push AX
;;  mov  al,"*"
;;  call write_tty
;;  pop  AX
                CMP     READ_ONLY_FLAG,1        ;Is this a write protect disk?
                JNZ     CK_RANGE                ;If no, go check range.
                CMP     AL,INPUT_COMMAND        ;Else, is this an write request?
                MOV     AX,WRITE_PROTECT        ;Assume yes; write violation.
                JNZ     IO_ERROR                ;If guessed right, exit.

CK_RANGE:       MOV     CX,ES:BYTE_OR_SECTOR_COUNT[DI]  ;Retrieve sector count.
                MOV     BP,ES:STARTING_SECTOR[DI]       ;Retrieve starting sector
                MOV     BX,BP                           ; and save in BX.
                CMP     BP,TOTAL_SECTORS        ;If starting sector greater
                MOV     AX,SECTOR_NOT_FOUND     ; or equal to total sectors
                JAE     IO_ERROR                ; then out of range.
                ADD     BX,CX                   ;If starting + count > total
                CMP     BX,TOTAL_SECTORS        ; then out of range.
                JBE     SAVE_PAGE_MAP

IO_ERROR:       MOV     ES:BYTE_OR_SECTOR_COUNT[DI],0   ;No sectors moved.
                RET

SAVE_PAGE_MAP:  MOV     DX,HANDLE               ;Retrieve EMM handle.
                MOV     AH,47H                  ;Preserve current expanded
                INT     67H                     ; memory registers.
                OR      AH,AH                   ;Was there an error?
                MOV     AX,DEVICE_NOT_READY     ;If yes, return error.
                JNZ     IO_ERROR

                PUSH    DS                              ;Preserve data segment.
                MOV     DX,BYTES_PER_SECTOR             ;Retrieve bytes/sector.
                MOV     AX,ES:TRANSFER_SEGMENT[DI]      ;Destination, transfer
                MOV     DI,ES:TRANSFER_OFFSET[DI]       ; segment and offset.
                MOV     BX,FRAME_SEGMENT                ;Source EMM segment.
                CMP     COMMAND,INPUT_COMMAND           ;Is this a DOS read request?
                JNZ     SET_SEGMENTS                    ;If no, write; guessed right.
                XCHG    AX,BX                           ;Else, read request; swap
                MOV     SI,DI                           ; source and destination.

SET_SEGMENTS:   MOV     DS,AX                   ;Set segments.
                MOV     ES,BX
                MOV     AX,-1                   ;Initialize page out of range.

NEXT_SECTOR:    PUSH    CX                      ;Save sector count.
                PUSH    DX                      ;Save bytes/sector.
                MOV     AX,BP                   ;Requested sector times
                MUL     DX                      ; bytes/sector = bytes offset.
                MOV     CX,SIXTEEN_K            ;Divide by 16K; quotient = page
                DIV     CX                      ; remainder = offset.
                CMP     AX,BX                   ;Is request page currently in
                JZ      MOVE_SECTOR             ; memory?  If yes, continue.

                MOV     BX,AX                           ;Make requested current page.
                CMP     CS:COMMAND,INPUT_COMMAND        ;Is it a read request?
                JNZ     OUTPUT_CODE                     ;If no, write request.
                MOV     SI,DX                           ;If read, SI = destination.
                JMP     SHORT MAP_PAGE
OUTPUT_CODE:    MOV     DI,DX                   ;If write, DI = destination.
MAP_PAGE:       XOR     AL,AL                   ;AL = physical page; BX = logical
                MOV     DX,CS:HANDLE            ;DX = EMM handle.
                MOV     AH,44H                  ;Map the page into memory.
                INT     67H

MOVE_SECTOR:    POP     DX                      ;Retrieve bytes/sector.
                MOV     CX,DX                   ;Move in counter.
                SHR     CX,1                    ;Divide by two.
                REP     MOVSW                   ;Move CX words.
                INC     BP                      ;Next requested sector.
                POP     CX                      ;Retrieve sector count.
                LOOP    NEXT_SECTOR             ;Do all requested sectors.

                POP     DS                      ;Restore data segment.
                MOV     DX,HANDLE               ;EMM handle.
                MOV     AH,48H                  ;Restore Page Map.
                INT     67H
                XOR     AX,AX                   ;Return success code.
                RET

INPUT_OUTPUT    ENDP

;-----------------------------------------------;
; Return password and parsing results to XPANBOSS. ;
;-----------------------------------------------;
IOCTL_INPUT     PROC    NEAR

                MOV     CX,PASSWORD_LENGTH                      ;Is password length same
                CMP     CX,ES:BYTE_OR_SECTOR_COUNT[DI]          ; as byte count request?
                JZ      IOCTL_WRITE                             ;If yes, continue.
                MOV     ES:BYTE_OR_SECTOR_COUNT[DI],0           ;Else, zero transferred.
                MOV     AX,UNKNOWN_UNIT                         ;Unknown unit.
                JMP     SHORT IO_INPUT_END

IOCTL_WRITE:    PUSH    DS                                      ;Save segments and
                PUSH    AX                                      ; and counter.
                PUSH    CX

                MOV     DS,ES:TRANSFER_SEGMENT[DI]              ;Point to XPANBOSS's
                MOV     SI,81H                                  ; PSP command line.
                CALL    PARSE                                   ;Parse the parameters.

                POP     CX                                      ;Restore registers.
                POP     ES
                POP     DS

                MOV     SI,OFFSET PASSWORD                      ;Point to password.
                MOV     AX,ES:TRANSFER_OFFSET[DI]               ;Destination, XPANBOSS
                MOV     ES,ES:TRANSFER_SEGMENT[DI]              ; communication pipe.
                MOV     DI,AX
                REP     MOVSB                                   ;Transfer the password.

                MOV     AL,PARA_FLAG            ;Parameter found?
                AND     AX,BP                   ;WITHOUT confirmation flag.
                STOSB                           ;Return 1 if should prompt user.

                XOR     AX,AX                   ;Successful.
IO_INPUT_END:   RET

IOCTL_INPUT     ENDP

;-----------------------------------------------------------------;
; If counter password confirms, then XPANBOSS OK'ed disk parameter changes.;
;-----------------------------------------------------------------;
IOCTL_OUTPUT    PROC    NEAR

                MOV     CX,PASSWORD_LENGTH                      ;Is password length same
                CMP     CX,ES:BYTE_OR_SECTOR_COUNT[DI]          ; as byte count request?
                JNZ     IOCTL_ERROR                             ;If no, not XPANBOSS.
                PUSH    ES                                      ;Save request header
                PUSH    DI                                      ; pointers.
                MOV     SI,OFFSET PASSWORD                      ;Check if counter
                MOV     AX,ES:TRANSFER_OFFSET[DI]               ; password confirms.
                MOV     ES,ES:TRANSFER_SEGMENT[DI]
                MOV     DI,AX
                REPZ    CMPSB
                POP     DI                                      ;Restore registers.
                POP     ES
                JNZ     IOCTL_ERROR                             ;If bad password, exit.

                CMP     PARA_FLAG,1                             ;Any parameters?
                JNZ     IOCTL_DONE                              ;If no, our task done.

                MOV     DX,HANDLE                               ;Retrieve EMM handle.
                MOV     AH,45H                                  ;Deallocate Pages.
                INT     67H
                CALL    ALLOCATE                                ;Allocate new pages.
                JC      IOCTL_ERROR                             ;Error exit if failed.

IOCTL_DONE:     CALL    STATISTICS                              ;Else, display stats.
                XOR     AX,AX                                   ;Return successful.
                JMP     SHORT IO_OUTPUT_END

IOCTL_ERROR:    MOV     ES:BYTE_OR_SECTOR_COUNT[DI],0           ;Else, zero transferred.
                MOV     AX,UNKNOWN_UNIT                         ;Unknown unit.

IO_OUTPUT_END:  RET

IOCTL_OUTPUT    ENDP

;-------------------------------;
; INPUT - DS:SI Points to parameters.
;-------------------------------;
PARSE           PROC    NEAR

                PUSH    CS                      ;Point ES to local data.
                POP     ES
                MOV     ES:PARA_FLAG,0          ;Initialize variables.
                MOV     ES:READ_ONLY_FLAG,0
                MOV     ES:DISK_SIZE_TEMP,DISK_SIZE_DEFAULT
                MOV     ES:SECTOR_SIZE_TEMP,SECTOR_SIZE_DEFAULT
                MOV     ES:ROOT_ENTRIES_TEMP,ROOT_ENTRIES_DEFAULT

                MOV     BP,1                    ;WITHOUT asking flag; assume yes.

NEXT_PARSE:     LODSB                           ;Get a byte.
                CMP     AL,CR                   ;If carriage return
                JZ      PARSE_END               ; or linefeed, done.
                CMP     AL,LF
                JZ      PARSE_END
                CMP     AL,"/"                  ;Switch character?
                JNZ     NEXT_PARSE              ;If no, next byte.
                LODSB                           ;Else, get switch.
                CMP     AL,CR                   ;If CR or LF, done.
                JZ      PARSE_END
                CMP     AL,LF
                JZ      PARSE_END
                AND     AL,5FH                  ;Else, capitalize
                CMP     AL,"M"                  ;Is it Minimum?
                JNZ     CK_A
                MOV     ES:DISK_SIZE_TEMP,DISK_SIZE_MINIMUM
                JMP     SHORT PARA_CHANGED

PARSE_END:      RET
CK_A:           CMP     AL,"A"                  ;Is it maximum?
                JNZ     CK_R
                MOV     ES:DISK_SIZE_TEMP,DISK_SIZE_MAXIMUM
```

(XPANDISK.ASM continues)

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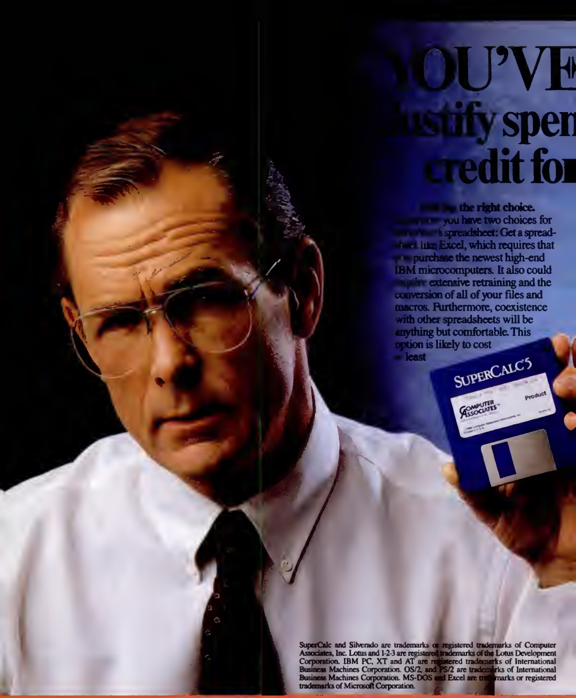

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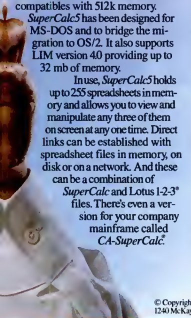

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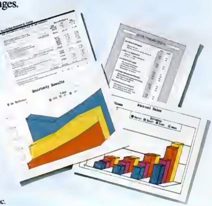

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■ UTILITIES

```
                JMP     SHORT PARA_CHANGED

CK_R:           CMP     AL,"R"                  ;Is it Read-only?
                JNZ     CK_W
                MOV     ES:READ_ONLY_FLAG,1

CK_W:           CMP     AL,"W"                  ;Is it WITHOUT asking?
                JNZ     CK_PARA
                XOR     BP,BP                   ;WITHOUT confirmation flag.

CK_PARA:        CALL    DECIMAL_INPUT           ;Get decimal number.

                CMP     AL,"D"                  ;Is switch character Disk Size?
                JNZ     CK_S
                CMP     BX,DISK_SIZE_MINIMUM    ;If yes, check boundaries.
                JAE     CK_D_MAX
                MOV     BX,DISK_SIZE_MINIMUM
CK_D_MAX:       CMP     BX,DISK_SIZE_MAXIMUM
                JBE     STORE_D_TEMP
                MOV     BX,DISK_SIZE_MAXIMUM
STORE_D_TEMP:   MOV     ES:DISK_SIZE_TEMP,BX
                JMP     SHORT PARA_CHANGED

CK_S:           CMP     AL,"S"                  ;Is it Sector Size?
                JNZ     CK_E
                MOV     CX,SECTOR_SIZE_MINIMUM  ;If yes, check boundaries.
                CMP     BX,CX
                JBE     STORE_S_TEMP
                MOV     CX,SECTOR_SIZE_MAXIMUM
                CMP     BX,CX
                JAE     STORE_S_TEMP
                MOV     CX,SECTOR_SIZE_DEFAULT
STORE_S_TEMP:   MOV     ES:SECTOR_SIZE_TEMP,CX
                JMP     SHORT PARA_CHANGED

CK_E:           CMP     AL,"E"                  ;Is it Root Directory Entries?
                JNZ     PARA_END
                CMP     BX,ROOT_ENTRIES_MINIMUM ;If yes, check boundaries
                JAE     CK_E_MAX
                MOV     BX,ROOT_ENTRIES_MINIMUM
CK_E_MAX:       CMP     BX,ROOT_ENTRIES_MAXIMUM
                JBE     STORE_E_TEMP
                MOV     BX,ROOT_ENTRIES_MAXIMUM
STORE_E_TEMP:   MOV     ES:ROOT_ENTRIES_TEMP,BX

PARA_CHANGED:   OR      ES:PARA_FLAG,1          ;Flag that parameter found.
PARA_END:       JMP     NEXT_PARSE              ;Parse all parameters.

PARSE           ENDP

;----------------------------------;
; INPUT - SI points to parameter start.
; OUTPUT - SI points to parameter end. BX = number.
;----------------------------------;
DECIMAL_INPUT   PROC    NEAR

                PUSH    AX                      ;Save switch character.
                XOR     BX,BX                   ;Start with zero as number.
NEXT_DECIMAL:   LODSB                           ;Get a character.
                CMP     AL,CR                   ;Carriage return or linefeed?
                JZ      ADJUST_DEC              ;If yes, done here.
                CMP     AL,LF
                JZ      ADJUST_DEC
                CMP     AL,"/"                  ;Forward slash?
                JZ      ADJUST_DEC              ;If yes, done here.
                SUB     AL,"0"                  ;ASCII to binary.
                JC      NEXT_DECIMAL            ;If not between 0 and 9, skip.
                CMP     AL,9
                JA      NEXT_DECIMAL
                CBW                             ;Convert byte to word.
                XCHG    AX,BX                   ;Swap old and new number.
                MOV     CX,10                   ;Shift to left by multiplying
                MUL     CX                      ; last entry by ten.
                JC      DECIMAL_ERROR           ;If carry, too big.
                ADD     BX,AX                   ;Add new number and store in BX.
                JNC     NEXT_DECIMAL            ;If not carry, next number.
DECIMAL_ERROR:  MOV     BX,-1                   ;Else, too big; return -1.

ADJUST_DEC:     DEC     SI                      ;Adjust pointer.
                POP     AX                      ;Restore switch character.
                RET

DECIMAL_INPUT   ENDP

;----------------------------;
;  OUTPUT - CY = 0 if successful. CY = 1 if unsuccessful.
;----------------------------;
ALLOCATE        PROC    NEAR

                PUSH    ES                      ;Save request header pointers.
                PUSH    DI

                MOV     BX,DISK_SIZE_TEMP       ;Retrieve disk size request.
                ADD     BX,15 + 16              ;Round up and adjust for DEC.
                MOV     CL,4                    ;Convert to number of 16K pages.
                SHR     BX,CL

NEXT_ALLOCATE:  DEC     BX                      ;Decrement page request until
                JNZ     GET_MEMORY              ; filled with memory available.
                STC                             ;Error if no memory available.
                JMP     ALLOCATE_END

GET_MEMORY:     MOV     AX,43H                  ;Allocate Pages.
                INT     67H
                OR      AX,AX                   ;Successful?
                JNZ     NEXT_ALLOCATE           ;If no, decrement by one page.

                MOV     PAGES,BX                ;Store pages.
                MOV     HANDLE,DX               ;Store new EMM handle.

                SHL     BX,CL                   ;Convert back to K bytes.
                MOV     DISK_SIZE,BX            ;Store size of disk for stats.

                MOV     BP,SECTOR_SIZE_TEMP     ;Retrieve sector size request.
NEXT_SECTORS:   MOV     AX,ONE_K                ;Disk size * 1024 / sector size
                MUL     BX                      ; = total sectors.  Total sectors
                SUB     AX,BP                   ; cannot exceed 64K.  Adjust
                SBB     DX,0                    ; sector size up until total
                CMP     DX,BP                   ; sectors <= 64K.
```

```
                JB      GOT_SECTORS             ; (Decrement by one sector to
                SHL     BP,1                    ; make division by zero easy
                JMP     SHORT NEXT_SECTORS      ; to detect and avoid.)

GOT_SECTORS:    DIV     BP                      ;Divide to get total sectors - 1.
                INC     AX                      ;Increment to get total sectors.
                OR      AX,AX                   ;Can't have 65536 (64K) sectors.
                JNZ     SECTORS                 ;That is, sector total is not
                DEC     AX                      ; a zero based number.
                DEC     AX
SECTORS:        MOV     TOTAL_SECTORS,AX        ;Store sector count.
                PUSH    AX                      ;Save results.
                MOV     BYTES_PER_SECTOR,BP     ;Store bytes/sector.

                MOV     DX,BP                   ;Retrieve sector size.
                MOV     CL,5                    ;Divide by 32 = entries/sector.
                SHR     DX,CL
                MOV     AX,ROOT_ENTRIES_TEMP    ;Retrieve entries requested.
                DIV     DL                      ;Divide by entries/sector.
                ADD     AH,-1                   ;Round if remainder.
                ADC     AL,0
                XOR     AH,AH                   ;Zero in high half.
                MOV     BX,AX                   ;Save directory sectors.
                MUL     DL                         ;Times entries/sector
                MOV     ROOT_DIRECTORY_ENTRIES,AX  ; = total directory entries.

                POP     AX                      ;Retrieve total sectors.
                MOV     CL,1                    ;Assume 1 sector/cluster.
                CMP     AX,THIRTY_TWO_K - 2     ;If total over half of maximum.
                JB      STORE_RESULTS           ;If yes, assumed right.
                INC     CL                      ;Else, use 2 sectors/cluster.
STORE_RESULTS:  MOV     SECTORS_PER_CLUSTER,CL  ;Store sectors/cluster.

                SUB     AX,BX                   ;Subtract directory sectors
                DEC     AX                      ;Subtract boot sector
                SHR     CL,1                    ;Divide cluster size by 2.
                SHR     AX,CL                   ;Divide to get clusters.
                MOV     CX,AX                   ;Save clusters in CX.
                SHL     AX,1                    ;Clusters * 2 = 16 bit FAT bytes.
                MOV     BL,0FFH                 ;0FFh as 3rd byte in 16 bit FAT.
                CMP     CX,TWELVE_BIT_FAT
                JA      GOT_FAT                 ;If clusters > 4087, 16 bit FAT.
                ADD     AX,CX                   ;Else, 1.5 bytes per 12 bit FATs.
                INC     AX                      ;Round up.
                SHR     AX,1
                XOR     BL,BL                   ;Use zero as 3rd byte in FAT.

GOT_FAT:        XOR     DX,DX                   ;Zero in high half.
                DIV     BP                      ;Divide by bytes/sector.
                ADD     DX,-1                   ;Round up.
                ADC     AX,0
                MOV     SECTORS_PER_FAT,AX      ;Store sectors/FAT.

                CALL    FORMAT                  ;Format the disk.
                CLC                             ;CY = 0 for success.

ALLOCATE_END:   POP     DI                      ;Restore request header pointers.
                POP     ES
                RET

ALLOCATE        ENDP

;----------------------------;
;  INPUT - BL = 00h for 12 bit fat. BL = FFh for 16 bit fat.
;----------------------------;
FORMAT          PROC    NEAR

                PUSH    AX                      ;Save BX.
                MOV     DX,HANDLE               ;Retrieve EMM handle.
                MOV     CX,PAGES                ;Retrieve pages.
                CMP     CX,3                    ;Maximum for Boot, FAT, and
                JB      NEXT_MAP_PAGE           ; directory = 3 * 16K pages.
                MOV     CX,3
NEXT_MAP_PAGE:  MOV     AX,CX                   ;Physical page.
                DEC     AX                      ;Pages are zero based.
                MOV     BX,AX                   ;Logical page the same.
                MOV     AX,44H                  ;Map Handle Page.
                INT     67H
                LOOP    NEXT_MAP_PAGE           ;Map all necessary pages.
                MOV     AX,FRAME_SEGMENT        ;Retrieve frame segment.
                MOV     ES,AX
                XOR     DI,DI                   ;Offset of zero.
                MOV     SI,OFFSET BOOT_RECORD         ;Store boot record
                MOV     CX,BOOT_RECORD_LENGTH / 2     ; in sector zero.
                REP     MOVSW

                MOV     DI,BYTES_PER_SECTOR     ;Retrieve bytes/sector; sector 1.
                MOV     AX,SECTORS_PER_FAT      ;Retrieve sectors/FAT.
                MUL     DI                      ;Multiply to get total bytes.
                MOV     CX,AX
                MOV     AL,MEDIA_DESCRIPTOR     ;Store media descriptor
                STOSB                           ; as first FAT byte.

                MOV     AX,0FFFFH               ;0FFFFh next two bytes of FAT.
                STOSW
                POP     BX                      ;0 for 12 bit FAT; 0FFh for 16
                MOV     AL,BL                   ; bit FAT next byte.
                STOSB

                SUB     CX,4                    ;Adjust FAT bytes by 4 control
                SHR     CX,1                    ; bytes; divide by two for words.
                XOR     AX,AX                   ;Format FAT with zeros.
                REP     STOSW

                MOV     SI,OFFSET VOLUME_LABEL  ;DI now points to directory.
                MOV     CX,VOLUME_LENGTH / 2    ;Store volume label as first
                REP     MOVSW                   ; entry in directory.

                MOV     AX,ROOT_DIRECTORY_ENTRIES   ;Retrieve directory entries.
                DEC     BX                          ;Less one for volume entry.
                MOV     CL,4                        ;Times 32 / 2 bytes per word.
                SHL     BX,CL
                MOV     CX,BX
                REP     STOSW                   ;Zeros in directory.

                MOV     FORMAT_FLAG,1           ;Tell Media Check disk changed.
                RET
```

(XPANDISK.ASM continues)

```
FORMAT          ENDP

;----------------------------------------------------------;
; Display disk size, sector size, and directory entries.  ;
;----------------------------------------------------------;
STATISTICS:     MOV     SI,OFFSET DISK_SIZE_MSG
                CALL    TTY_STRING
                MOV     AX,DISK_SIZE
                CALL    DECIMAL_OUTPUT
                MOV     SI,OFFSET SECTOR_SIZE_MSG
                CALL    TTY_STRING
                MOV     AX,BYTES_PER_SECTOR
                CALL    DECIMAL_OUTPUT
                MOV     SI,OFFSET DIRECTORY_ENTRIES_MSG
                CALL    TTY_STRING
                MOV     AX,ROOT_DIRECTORY_ENTRIES
                CALL    DECIMAL_OUTPUT
                RET
;-------------------------;
TTY:            CALL    WRITE_TTY
TTY_STRING:     LODSB
                OR      AL,AL
                JNZ     TTY
                RET
;-------------------------;
WRITE_TTY:      MOV     AH,0EH
                INT     10H
                RET
;-------------------------;
PRINT_STRING:   MOV     AH,9
                INT     21H
                RET

;---------------------------------------;
; INPUT: AX = number.
;---------------------------------------;
DECIMAL_OUTPUT PROC     NEAR

                MOV     BX,10                           ;Divisor of ten.
                XOR     CX,CX                           ;Zero in counter.
NEXT_COUNT:     XOR     DX,DX                           ;Zero in high half.
                DIV     BX                              ;Divide by ten.
                ADD     DL,"0"                          ;Convert to ASCII.
                PUSH    DX                              ;Save results.
                INC     CX                              ;Also increment count.
                CMP     AX,0                            ;Are we done?
                JNZ     NEXT_COUNT                      ;Continue until zero.
                MOV     BX,CX                           ;Save the number of characters.

NEXT_NUMBER:    POP     AX                              ;Retrieve numbers.
                CALL    WRITE_TTY                       ;And write them.
                LOOP    NEXT_NUMBER
                RET

DECIMAL_OUTPUT ENDP

EVEN
MAX_RESIDENT    EQU     $

;************** END OF RESIDENT PORTION *************;

HEADING         LABEL   BYTE
COPYRIGHT       DB      CR,LF,"XPANDISK.SYS 1.0 (C) 1988 Ziff Communications Co."
PROGRAMMER      DB      CR,LF,"PC Magazine ",BOX," Michael J. Mefford",CR,LF,LF

DB "Syntax: XPANDISK.SYS [/D disk size][/S sector size][/E entries][/M][/A]"
DB CR,LF,LF
DB "disk size   = (16 - 32768)K bytes; default = 64",CR,LF
DB "sector size = (128,256,512) bytes; default = 256",CR,LF
DB "entries     = (4 - 512)in root directory; default = 64",CR,LF
DB "/M = Minimum disk size (16K)",CR,LF
DB "/A = All of available expanded memory",CR,LF,LF

DB "Use XPANBOSS.COM to control installed XPANDISK",CR,LF,"$"

EMM             DB      "EMMXXXX0"
EMM_LENGTH      EQU     $ - EMM
EMM_NOT_FOUND   DB      CR,LF,"Expanded memory driver not found",CR,LF,LF,"$"
```

```
INSTALLED       DB      CR,LF,LF,"XPANDISK installed",CR,LF,LF,"$"

;---------------------------------------------;
; INPUT - ES:DI points to request header.
; OUTPUT - AX = Error status
;---------------------------------------------;
INIT            PROC    NEAR

                MOV     DX,OFFSET HEADING         ;Display copyright.
                CALL    PRINT_STRING

                PUSH    DS                        ;Save segment registers.
                PUSH    ES
                MOV     SI,ES:ARGUMENTS_OR_ARRAY_OFF[DI]    ;Point to CONFIG.SYS
                MOV     DS,ES:ARGUMENTS_OR_ARRAY_SEG[DI]    ; XPANDISK parameters.
PARSE_LEADING:  LODSB                                       ;Parse off any leading
                CMP     AL,SPACE                  ; white space after DEVICE =
                JBE     PARSE_LEADING
FIND_END:       LODSB                             ;Find end of "XPANDISK.SYS".
                CMP     AL,SPACE
                JA      FIND_END
                DEC     SI
                CALL    PARSE                     ;Parse parameters.
                POP     ES                        ;Restore segment registers.
                POP     DS

                MOV     ES:UNITS[DI],1            ;Set up header.
                MOV     ES:ARGUMENTS_OR_ARRAY_OFF[DI],OFFSET BPB_ARRAY
                MOV     ES:ARGUMENTS_OR_ARRAY_SEG[DI],CS

                PUSH    ES                        ;Save request header pointers.
                PUSH    DI
                MOV     AX,3567H                  ;Retrieve EMM interrupt vector.
                INT     21H
                MOV     DI,0AH                    ;See if offset 10 of vector
                MOV     SI,OFFSET EMM             ; points to EMMXXXX0.
                MOV     CX,EMM_LENGTH
                REPZ    CMPSB
                POP     DI                        ;Restore segments.
                POP     ES
                JNZ     NO_EMM                    ;Exit if EMM not found.

                MOV     AH,40H                    ;Get Status of EMM.
                INT     67H
                OR      AH,AH
                JNZ     NO_EMM                    ;Exit if not working.

                MOV     AH,41H                    ;Get Page Frame Address.
                INT     67H
                OR      AH,AH                     ;Exit if not available.
                JNZ     NO_EMM
                MOV     FRAME_SEGMENT,BX          ;Else, store.

                CALL    ALLOCATE                  ;Allocate memory and format disk.
                JNC     FOUND_EMM                 ;Exit with error if failed.

NO_EMM:         MOV     ES:ENDING_OFFSET[DI],OFFSET MIN_RESIDENT
                MOV     ES:ENDING_SEGMENT[DI],CS
                MOV     ES:UNITS[DI],0                ;Install zero units.
                MOV     EMM_FLAG,0                    ;Fail any other driver calls.
                MOV     DX,OFFSET EMM_NOT_FOUND       ;Tell user not installed.
                JMP     SHORT INIT_END

FOUND_EMM:      MOV     ES:ENDING_OFFSET[DI],OFFSET MAX_RESIDENT
                MOV     ES:ENDING_SEGMENT[DI],CS
                CALL    STATISTICS                    ;If successful installation
                MOV     DX,OFFSET INSTALLED       ; display stats and "installed".

INIT_END:       CALL    PRINT_STRING
                XOR     AX,AX
                RET

INIT            ENDP

_TEXT           ENDS
                END
```

(XPANDISK.ASM ends)

you know if you try, and it will not effect your request.

The two size parameters and directory entries work exactly as they do from the XPANDISK command line in the CONFIG.SYS file. The same holds true for the /M (Minimize) and /A (All) switches. If you enter XPANBOSS without parameters, you'll get a report of XPANDISK's current settings.

There are two new optional switches that do not appear in the XPANDISK syntax. The /R switch is used to make your XPANDISK read-only. Any attempt to write to a read-only disk will fail—including attempts by Trojan horse programs. For this reason you may wish to try out newly downloaded programs on a protected XPANDISK. Invoking the read-only status is also handy in preventing data files from being accidentally written over. Obviously, you don't want to make your RAMdisk read-only before you've put anything on it, which is why the /R switch doesn't appear in the XPANDISK syntax. (In fact, XPANDISK will blindly make a disk read-only if you were silly enough to add the /R switch.) You can remove the read-only attribute of the disk at any time (without disturbing the data) by simply entering XPANBOSS without any parameters except the drive specifier. None of the attribute-changing programs, such as ATTRIB, can remove the disk's read-only setting.

It's important to realize, however, that with the exception of the /R (Read-only) option, changing RAMdisk's configuration reformats it as a blank disk, wiping out any previous files stored on it. The effect is the same as if you'd entered the DOS FORMAT command. I could (with enough effort) have written XPANBOSS in such a way as to allow making a disk larger without losing data, but, obviously, cutting a disk down in size would still lose files. To keep things simple, therefore, XPANBOSS starts the RAMdisk out with a completely clean slate after resizing.

For this reason, whenever you try to change the disk size you are warned and asked if you wish to continue. The prompt requires you to type a "Y" and press Enter before XPANBOSS will make any

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changes. Pressing any other key combination aborts the XPANBOSS command so you can go back and save any files you want onto a more permanent medium.

There are times, however, when a confirming response would be a nuisance. With this in mind, I included the /W (Without asking) option. If you add /W to the command line, XPANBOSS will reformat the disk without any warning, so use it with caution. It comes in very handy, however, when executing XPANBOSS from a batch file. (See the sidebar "Using XPANDISK".)

UNDERSTANDING XPANDISK Device drivers come in two basic flavors: character drivers, which process a character stream serially (1 byte at a time), and block drivers, which are able to handle a block of data at a time. Disk drives fall into the block driver category.

The role of a block device is to interpret the device and to shuttle sectors of data between DOS and the device. Normally, with a physical drive this involves moving the disk head to the appropriate track and saving or retrieving the data to or from the media. The "device" in XPANDISK's case is not a physical drive, of course, but expanded memory. Thus, all that XPANDISK does is move the data between DOS and the expanded memory.

The expanded memory addressing is a simple matter of indexing by an offset of the sector size times the requested sector. DOS takes care of all the nitty-gritty details of maintaining the FAT and directory structure of the disk. The device driver's duty is to maintain the device. With XPANDISK that means communicating with the EMM provided with your memory board and swapping the memory containing the requested sectors into the 64K window. EMM—also a device specialist—takes care of details such as who owns what memory and manipulating the registers on the expanded memory board that place particular pages of memory on the bus.

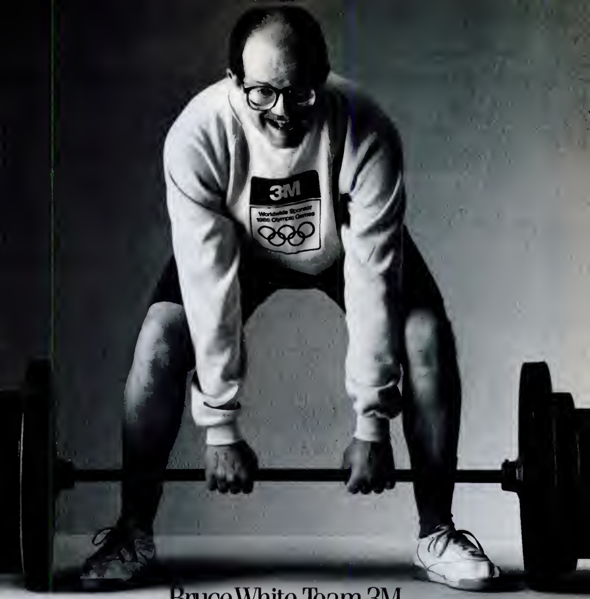
With all this support, then, what might seem on the surface to be a monumental task is quite simple for XPANDISK. XPANDISK is in many ways very similar to the VDISK driver. The main difference is that XPANDISK emulates its disk in expanded memory whereas VDISK uses conventional or extended memory.

THE EMM From the programmer's point of view, the EMM (Expanded Memory Manager) function requests are accessed in the same way as DOS functions.

```
100 REM - BASIC PROGRAM TO CREATE XPANDISK.SYS
110 CLS:PRINT "Creating XPANDISK.SYS": OPEN "XPANDISK.SYS" AS #1 LEN = 1
120 FIELD #1, 1 AS A$: CHECKSUM#=0
130 FOR I = 1 TO  118
140  LINESUM#=0: LOCATE 2,3: PRINT "Countdown: "  118 - I ;
150  FOR J = 1 TO  16: READ BYTE$: CHECKSUM#=CHECKSUM#+VAL("&H"+BYTE$)
160   LINESUM#=LINESUM#+VAL("&H"+BYTE$)
170   IF (BYTE < 256) THEN LSET A$=CHR$(VAL("&H"+BYTE$)): PUT #1
180  NEXT J
190  READ LINETOT$: LINECHECK# = VAL("&H"+LINETOT$)
200  IF LINECHECK# = LINESUM# THEN GOTO 220
210  LOCATE 6,2: PRINT "Error in line #" ;  260 +  10 * I: GOTO 260
220 NEXT I
230 CLOSE: READ FILETOT$ : FILECHECK# = VAL(FILETOT$)
240 IF CHECKSUM# <> FILECHECK# THEN GOTO 260
250 PRINT: PRINT "XPANDISK.SYS created successfully": SYSTEM
260 PRINT: PRINT "XPANDISK.SYS is not valid!": END
270 DATA FF, FF, FF, FF,  0, 40, 17,  0, 22,  0,  1,  0,  0,  0,  0,  0,   476
280 DATA  0,  E,  1,  0,  0,  0,  0, 20, 09, 1E, 13,  0, 2E, 0C,  6, 15,   1B0
290 DATA  0, CB, 90, 92, 91, 92, 1E,  6, 56, 27, 22, 9C, FC,  E, 1F, 00,   97C
300 DATA 3E, 12,  0,  1, B5,  1, 00, 79, 10, C6, 3E, 13,  0, 26, 8A, 2D,   639
310 DATA  2, 0E, FB,  C, B5,  3, 00, 77,  0, 32, FF, D1, E3, FF, 97, 66,   824
320 DATA  0, C5, 3E, 13,  0,  D,  0,  1, 09, 45,  3, 9D, 5D, 5F, 5E,  7,   3B3
330 DATA 1F, 5A, 99, 9B, 55, CB, C7,  6, 2D,  1, 61,  1, FC,  1, 23,  1,   4DE
340 DATA 0A,  1, 2A,  1, 0A,  1, 53,  1, 23,  1, 0A,  3, 2A,  1, 30,  2,   1B9
350 DATA  0,  0,  0, 50, 50, 61, 4E, 44, 49, 53, 6B,  0,  1,  1,  1,  0,   262
360 DATA  1, 60,  0,  0,  1, FE,  1,  0,  0,  0,  1,  0,  0,  0, 40,  0,   18A
370 DATA  0,  1, 60,  0, 40,  0,  0,  0,  1, EB,  0, 50, 63, 4D, 41, 67,   272
380 DATA 20, FE, 20, 4D, 4A, 6D, 20,  0,  0,  0,  0,  0,  0,  0,  0,  0,   24A
390 DATA  0,  0, 60, E1, 10,  E,  E,  E,  0,  0,  0, 90, 63, 20, 4D, 61,   2B2
400 DATA 67, 61, 7A, 66, 6E, 65, 20, 20, 72, 6F, 66, 79, 63, 76, 69, 76,   650
410 DATA 69, 76, 76,  D,  A, 44, 69, 73, 6B, 20, 53, 69, 7A, 62, 20, 20,   4F3
420 DATA 20, 20, 20, 20, 20, 2E, 20,  0, 6D,  D,  A, 93, 69, 63, 76, 6F,   340
430 DATA 72, 20, 63, 69, 7A, 66, 20, 20, 20, 20, 20, 20, 20,  0,  D,  A,   324
440 DATA 66, 69, 72, 69, 63, 74, 6F, 72, 76, 20, 69, 6E, 76, 72, 69, 65,   63C
450 DATA 73, 20,  0,  0,  0,  0,  0,  0,  0,  0, 33, C0, C3, 26, C6, 45,   37A
460 DATA  0,  1, 00, 3E, A0,  0,  1, 72,  2, 26, C0, 69,  0, FF, 33, C0,   521
470 DATA C3, 36, C7, 42, 12, 0D,  0, 26, 6C, 4D, 14, C6,  6, A0,  0,  0,   519
480 DATA 33, C0, C3, 26, 8A, 49,  2, A2, 23,  1, 00, 3E, A7,  0,  1, 75,   54E
490 DATA  7, 3C,  6, B0,  0, 00, 75, 10, 26, 0B, 4D, 12, 26, 0B, 6D, 14,   451
500 DATA 0B, DD, 3B, 20, 93,  0, B8,  0, 00, 73,  0,  2, D9, 3B, 1E, 93,   5E7
510 DATA  0, 76,  7, 26, C7, 45, 12,  0,  0, C3, 0D, 16, 26,  1, B4, 67,   447
520 DATA CD, 07,  A, E4, B0,  2, 00, 75, BE, 1E, 0D, 16, 0D,  0, 26, 0B,   606
530 DATA 49, 10, 26, 0B, 75,  B, 0B, 1B, 24,  1, 00, 3B, 23,  1,  4, 79,   3B2
540 DATA  3, 93, 0B, FB, 0E, D5, 0E, C3, A0, FF, FF, 91, 92, 0B, C2, F7,   A79
550 DATA E2, B9,  0, 60, F7, F1, 3B, C3, 76, 1B, 0B, D5, 2E, 00, 3E, 23,   7C2
560 DATA  1,  6, 79,  4, 0B, F2, EB,  2, 0B, FA, 32, C0, 2E, 0B, 16, 26,   654
570 DATA  1, B4, 66, CD, 67, 5B, 0B, CA, D1, E9, F3, A0, 69, 59, E2, CB,   979
580 DATA 1F, 0D, 16, 26,  1, B6, 40, CD, 67, 33, C0, C3, B9, 10,  0, 26,   5C4
590 DATA 3B, 4D, 12, 76,  B, 26, C7, 65, 12,  0,  0, B0,  1, 00, EB, 27,   4A0
600 DATA 1E,  6, 51, 20, 0E, 5D, 10, BE, 01,  0, E5, 9E,  0, 59,  7, 1F,   49A
610 DATA BE, CB,  0, 26, 0E, 65,  E, 26, 0A, 46, 10, 0B, F0, F3, A0, A0,   750
620 DATA A0,  0, 23, C2, 0A, 33, C0, C3, B9, 10,  0, 26, 3B, 4D, 12, 72,   2F4
630 DATA 30,  6, 57, BE, CD,  0, 26, 0B, 69,  0, 26, 0E, 49, 10, 0B, F0,   5A6
640 DATA F3, A0, 5F,  7, 75, 1D, 50, 3B, A0,  0,  1, 79,  D, 0E, 16, 26,   53D
650 DATA  1, B4, 49, CD, 67, 00,  9,  1, 72,  7, E0,  B,  2, 33, C0, EB,   640
660 DATA  6, 26, C7, 45, 12,  0,  0, B0,  1, 00, C3,  B,  7, 26, C6,  6,   450
670 DATA A0,  0,  0, 26, C6,  6, A7,  0,  0, 26, C7,  6, 9E,  0, 40,  0,   410
680 DATA 26, C7,  0, A0,  0,  0,  1, 26, C7,  6, A2,  0, 40,  0, BD,  1,   427
690 DATA  E, AC, 3C,  D, 74, 20, 3C,  A, 74, 1C, 3C, 2F, 79, F3, AC, 3C,   51A
700 DATA  D, 74, 13, 3C,  A, 74,  F, 24, 5F, 3C, 4D, 75,  A, 26, C7,  6,   3DB
710 DATA 6E,  0, 10,  0, EB, 73, C3, 3C, 41, 75,  6, 26, C7,  6, 9B,  0,   550
720 DATA  0, 00, EB, 65, 3C, 22, 75,  6, 26, C6,  6, A7,  0,  1, 3C, 57,   506
730 DATA 79,  2, 33, ED, E0, 9B,  0, 3C, 64, 75, 10, 03, FB, 10, 73,  3,   5EB
740 DATA BB, 10,  0, 5I, FB,  0, 00, 76,  3, BE,  0, 50, 26, 09, 1E, 9E,   5E6
750 DATA  0, EB, 36, 3C, 23, 75, 10, B6, 50,  0, 3B, D6, 76,  A, B9,  0,   5C3
760 DATA  2, 3B, D6, 73,  2, 09,  0,  1, 26, 56,  E, A0,  0, EB, 1A, 3C,   4E4
770 DATA 49, 75, 1C, 03, FE,  4, 73,  3, BE,  4,  0, 01, FE,  0,  2, 76,   581
```

```
780 DATA  2, BE,  0,  2, 20, 09, 1E, A2,  0, 26, 00,  E, A0,  0,  1, E9,   673
790 DATA 9F, FF, 50, 33, DB, AC, 3C,  D, 76, 20, 3C,  A, 76, 1C, 3C, 2F,   506
800 DATA 76, 10, 2C, 30, 72, EF, 3C,  9, 77, EB, 90, 93, B9,  A,  0, F7,   6D5
810 DATA E1, 72,  6,  3, D0, 73, DB, BE, FF, FF, 40, 50, C3,  6, 57, 0D,   80D
820 DATA 1E, 9E,  0, 03, C3, 1F, B1,  6, D3, ED, 4B, 75,  6, F9, E9, 0F,   7C9
830 DATA  0, B4, 43, CD, 67,  A, E4, 70, F1, 09, 1E, 26,  1, 09, 16, 20,   614
840 DATA  1, D3, E3, 09, 10, A0,  0, 0B, 2E, A0,  0, B0,  0,  6, F7, E3,   6F1
850 DATA 2B, C5, 03, DA,  0, 3B, D5, 72,  4, D1, 02, EB, EB, F7, F5, 60,   900
860 DATA  B, C0, 72,  2, 60, 60, A2, 93,  0, 90, 09, 2E, 5B,  0, 0B, D9,   9FA
870 DATA D1,  2, D3, EA, A1, A2,  0, F6, F2, 00, C4, FF, 16,  0, 32, E4,   900
880 DATA 0B, D0, F6, E2, A3, 91,  0, 50, B1,  1, 3D, FE, 7F, 72,  2, FE,   8A5
890 DATA C1, 00,  E, 8D,  0, 2B, C3, 60, D0, E9, D3, 00, 5D, C0, D1, E0,   992
900 DATA B3, FF, 01, FE, F7,  F, 77,  7,  3, C1, 60, D1, B0, 33, DE, 33,   8AD
910 DATA D2, F7, F9, 63, C2, FF, 19,  0,  0, A3, 96,  0, E0,  6,  0, F0,   836
920 DATA 9F,  7, C3, 93, 5B, 16, 26,  1, 0B,  E, 20,  1, 03, FE,  3, 72,   6F7
930 DATA  3, B9,  3,  0, 8E, C1, 40, 0B, D0, B6, 44, CD, 67, E3, FE, A1,   85A
940 DATA 24,  1, 8E, C0, 33, FF, BE, 00,  0, B9,  F,  0, F3, A0, BA, 3E,   70C
950 DATA 5B,  0, A1, 96,  0, F7, E7, 0B, C0, B0, FE, AA, D0, FF, FF, A0,   AAC
960 DATA 9B, 0A, C3, AA, 03, E9,  4, D1, E9, 33, C0, F3, A0, BE, A0,  0,   976
970 DATA B9, 10,  0, F3, A5, 9A, 1E, 91,  0, 4B, D1,  4, D3, E3, 0B, CB,   7A7
980 DATA F3, A5, C6,  6, A0,  0,  1, C3, BE, E3,  0, E5, 22,  0, A1, A0,   7C6
990 DATA  0, E0, 3C,  0, BE, FE,  0, E0, 16,  0, A1, 0B,  0, EB, 20,  0,   9FC
1000 DATA BE,  E,  1, E0,  A,  0, A1, 91,  0, E0, 14,  0, C3, B0,  6,  0,   59B
1010 DATA AC,  A, C0, 79, F0, C3, B6,  E, CD, 10, C3, B4,  9, CD, 21, C3,   876
1020 DATA 5B,  A,  0, 33, C9, 33, D2, F7, F3, 00, C2, 30, 22, 41, 3D,  0,   6F2
1030 DATA  0, 75, F2, 0B, D9, 50, E0, DD, FF, E2, FE, C3,  D,  A, 50, 50,   965
1040 DATA 41, 4E, 44, 66, 23, 6B, 2E, 93, 96, 53, 20, 31, 2E, 30, 20, 20,   3DE
1050 DATA 63, 29, 20, 31, 39, 30, 30, 20, 5A, 66, 66, 66, 20, 63, 6F, 6D,   626
1060 DATA 6D, 79, 60, 69, 63, 61, 76, 69, 6F, 60, 73, 20, 63, 6F, 2E,  D,   2B7
1070 DATA  A, 50, 43, 20, 4D, 61, 67, 61, 7A, 66, 5B, 65, 20, FE, 20, 6D,   974
1080 DATA 69, 63, 65, 61, 69, 6C, 20, 6A, 20, 20, 4D, 69, 66, 66, 6F, 72,   97D
1090 DATA 66,  D,  A,  A, 93, 79, 5B, 76, 61, 70, 2A, 20, 50, 90, 41, 6E,   49D
1100 DATA 46, 46, 93, 4B, 2E, 93, 99, 93, 20, 9B, 2F, 66, 20, 66, 69, 73,   4A6
1110 DATA 6B, 20, 73, 69, 7A, 65, 5D, 5B, 2F, 93, 20, 73, 65, 63, 76, 6F,   50E
1120 DATA 72, 20, 73, 66, 7A, 69, 5D, 5B, 2F, 69, 20, 69, 6B, 74, 72, 69,   5BB
1130 DATA 69, 73, 9D, 2B, 2F, 4D, 5D, 9B, 2F, 61, 9D,  D,  A,  A, 66, 69,   67F
1140 DATA 73, 6B, 20, 73, 66, 7A, 66, 20, 20, 20, 3D, 20, 20, 31, 36, 20,   425
1150 DATA 2D, 20, 33, 32, 37, 36, 30, 29, 6B, 20, 62, 79, 74, 69, 73, 3B,   44D
1160 DATA 20, 64, 65, 66, 61, 75, 6C, 76, 20, 3D, 20, 36, 34,  D,  A, 73,   676
1170 DATA 69, 63, 74, 6F, 72, 20, 73, 69, 7A, 65, 20, 3D, 20, 20, 21, 32,   500
1180 DATA 30, 2C, 32, 35, 36, 2C, 35, 31, 32, 29, 20, 62, 79, 74, 65, 72,   435
1190 DATA 3B, 20, 64, 69, 66, 61, 75, 6C, 76, 20, 3D, 20, 32, 35, 36,  D,   667
1200 DATA  A, 65, 6E, 76, 72, 69, 69, 73, 20, 20, 20, 20, 20, 3D, 20, 20,   429
1210 DATA 36, 20, 2D, 20, 35, 31, 32, 29, 69, 6E, 20, 72, 6F, 6F, 76, 20,   63D
1220 DATA 66, 69, 72, 62, 63, 74, 6F, 72, 76, 3B, 20, 66, 69, 66, 61, 75,   632
1230 DATA 6C, 76, 20, 3D, 20, 36, 36,  D,  A, 2F, 6D, 20, 3D, 20, 4D, 69,   34D
1240 DATA 5B, 66, 6D, 75, 6D, 20, 64, 69, 73, 6B, 20, 73, 66, 7A, 69, 20,   9EC
1250 DATA 20, 31, 36, 6B, 29,  D,  A, 2F, 61, 20, 3D, 20, 61, 6C, 6C, 20,   340
1260 DATA 6F, 66, 20, 61, 76, 61, 69, 6C, 61, 62, 6C, 69, 20, 69, 70, 70,   663
1270 DATA 61, 6E, 64, 69, 66, 20, 6D, 62, 4D, 6F, 72, 79,  D,  A,  A, 92,   52B
1280 DATA 73, 69, 20, 50, 50, 41, 4E, 62, 4F, 63, 53, 20, 43, 6F, 4D, 20,   493
1290 DATA 74, 6F, 20, 63, 6F, 6E, 76, 72, 0F, 6C, 20, 69, 6B, 73, 74, 61,   843
1300 DATA 6C, 6C, 69, 66, 20, 50, 50, 61, 4E, 44, 49, 93, 6B,  D,  A, 24,   49E
1310 DATA 69, 6D, 4D, 90, 96, 90, 90, 30,  D,  A, 69, 70, 70, 01, 6E, 64,   4E6
1320 DATA 62, 66, 20, 6D, 65, 6D, 6F, 72, 79, 20, 06, 72, 09, 76, 62, 72,   620
1330 DATA 20, 60, 6F, 76, 20, 66, 6F, 75, 6E, 66,  D,  A,  A, 26,  D,  A,   609
1340 DATA  A, 50, 50, 61, 4E, 66, 66, 53, 4D, 20, 69, 60, 73, 74, 61, 6C,   517
1350 DATA 6C, 69, 66,  D,  A,  A, 24, BE, CC,  6, E0, DE, FE, 1E,  6, 26,   611
1360 DATA 5D, 75, 12, 26, 0E, 5D, 14, AC, 3C, 20, 76, FE, AC, 3C, 20, 77,   62F
1370 DATA FE, 4E, E5, 66, FE,  7, 1F, 26, C6, 45,  D,  1, 24, C7, 45, 12,   66B
1380 DATA A0,  0, 26, 6C, 4D, 14,  6, 27, B0, 67, 36, CD, 21, BF,  A,  6,   224
1390 DATA BE, 00,  6, B9,  0,  0, F3, A0, 5F,  7, 72, 19, B4, 40, CD, 67,   68A
1400 DATA  A, E4, 75, 11, B4, 41, CD, 67,  A, E4, 75,  6, 59, 1B, 24,  1,   5D5
1410 DATA 05, 4A, FC, 73, 16, 26, C7, 45,  0, 60,  0, 26, 0C, 4D, 10, 26,   565
1420 DATA C6, 45,  D,  0, C6,  6, 12,  0,  0, BE, 05,  6, EB, 10, 26, C7,   526
1430 DATA 45,  E, CC,  4, 26, 6C, 4D, 10, 00, 2D, FD, BA, A5,  6, E5, 5A,   674
1440 DATA FE, 33, CB, C3,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,   2B3
1450 DATA 100520
```

XPANDISK.BAS: *Run this BASIC program to automatically create the same XPANDISK.SYS file created with XPANDISK.ASM.*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The function request is passed to EMM in the AH register, and any errors are returned in AH. The function entry point is via interrupt 67h instead of interrupt 21h. Version 3.*x* of the EMS (expanded memory specification) has 15 services; several advanced services were added with Version 4.0, but the hardware as well as the EMM driver has to be upgraded to make use of these advanced services. Fortunately, XPANDISK can do all its work with the original 15 services, which means that it can work with older hardware. Functions 1 to 7 are for general-purpose programming and provide all that's necessary for

USING XPANDISK

A couple of specific examples may stimulate your thinking about how best to make use of XPANDISK. For starters, you'll find that a RAMdisk is an ideal place to put COMMAND.COM. The reason is that large programs often overwrite the transient portion of COMMAND.COM that resides in high memory. Therefore, COMMAND.COM must be reloaded when you exit the application. If you have a floppy-disk-based system, that's the reason you get the "Insert a disk with COMMAND .COM" message.

In order to reload its missing part, the resident portion of COMMAND.COM searches the environment for the COMSPEC= statement, which is followed by the disk location of COMMAND.COM. (To look at the environment—and the COMSPEC—use the SET command.) Normally, COMSPEC will be the same disk drive from which you booted. Especially if you have a floppy disk system, the disk access needed to reload the transient portion of COMMAND.COM is annoyingly time-consuming. Reloading COMMAND.COM becomes instantaneous, however, if it is loaded from a RAMdisk.

To do this, first COPY COMMAND .COM to the RAMdisk and then change COMSPEC. This is most easily accomplished at boot time from within your AUTOEXEC.BAT. If you have a floppy-disk-only system and XPANDISK is installed as drive C:, you would add to your AUTOEXEC.BAT

```
COPY COMMAND.COM C:\
SET COMSPEC=C:\COMMAND.COM
```

When using this technique, be sure to COPY COMMAND.COM back to drive C: if you use XPANBOSS to resize it. If you don't, so the resident portion of COMMAND.COM can't find itself to load its transient portion, you'll get the awful message "Cannot load COMMAND.COM, System halted." If that happens, rebooting becomes the only road to recovery.

INCREASING FLEXIBILITY There are several ways to utilize the flexibility XPANDISK provides. One of these is to copy all your frequently used program files to the RAMdisk, from whence they can be quickly loaded into conventional memory whenever they need to be executed. Again, the best time to do this is when you are booting the machine. Assuming XPANDISK is installed as drive D: and you keep your utilities on drive C: in a directory called UTIL, you would add the following three commands to your AUTOEXEC.BAT:

```
MD D:\UTIL
COPY C:\UTIL\*.* D:\
PATH D:\UTIL
```

The ideal way to change disk size with XPANBOSS is also from within a batch file. To illustrate, let's assume your gargantuan spreadsheet program needs all of your expanded memory. (That ravenous spreadsheet may have been the reason you got expanded memory in the first place.) The following batch file model would release all excess expanded memory used by XPANDISK for *Lotus 1-2-3* to use and then reclaim the memory for the RAMdisk when the spreadsheet session ends:

```
XPANBOSS D:/M/W > NUL
CD \123
123
CD \
XPANBOSS D:/A/W > NUL
```

Note the redirection of XPANBOSS's output to the NUL device. This simply suppresses the syntax message that XPANBOSS would otherwise display. The disk statistics display can't be prevented, however. That's because the disk report circumvents DOS (and redirection) and is printed to the screen via the BIOS Write TTY function.

After running the batch file above, you would execute another batch file that would COPY the appropriate files to the reenlarged RAMdisk. Let's assume you are headed to an assembly-source-code editing and compiling session. Place the following commands in the MASM .BAT file for compiling the assembly listings that appear in this column:

```
ECHO off
CLS
CD \ASM
MASM %1,D:\%1.OBJ;
IF NOT EXIST D:\%1.OBJ GOTO END
LINK D:\%1, D:\%1;
EXE2BIN D:\%1 C:\COM\%1.COM
ECHO %1.COM successfully compiled.
:END
CD \
```

This example assumes that you keep your assembly listings in the \ASM directory of your C: drive and the resulting compiled .COM files in C:\COM directory. D: still represents the XPANDISK drive. The batch file stores the temporary .OBJ and .EXE files created by MASM and LINK on the RAM drive.

Naturally, you will have to modify this sample batch file to fit your actual disk structure. To enhance the batch file and the performance even further, follow the theme of storing program files in RAM by copying MASM.EXE, LINK .EXE, and EXE2BIN.EXE to drive D: when you first boot up the system or before the edit session. You would then preface the three compiler program references in the batch file with D:\. Similarly you could add D:\ to your path.

—Michael J. Mefford

```
;  XpanBoss: the control program for the XPANDISK.SYS
;  virtual disk expanded memory device driver. PC Magazine 10-31-88

_TEXT           SEGMENT PUBLIC 'CODE'
                ASSUME  CS:_TEXT,DS:_TEXT
                ASSUME  ES:_TEXT,SS:_TEXT
                ORG     100H

START:          JMP     MAIN

COPYRIGHT       DB      CR,LF,"XPANBOSS 1.0 (C) 1988 Ziff Communications Co."
PROGRAMMER      DB      CR,LF,"PC Magazine ",BOX," Michael J. Mefford",CR,LF,LF

DB "Syntax: XPANBOSS [d:][/D disk size][/S sector size][/E entries]"
DB "[/W][/R][/M][/A]",CR,LF,LF
DB "disk size   = (16 - 32768)K bytes; default = 64",CR,LF
DB "sector size = (128,256,512) bytes; default = 256",CR,LF
DB "entries     = (4 - 512)in root directory; default = 64",CR,LF
DB "/W = Change size WITHOUT asking. WARNING: All data will be lost.",CR,LF
DB "/R = Read-only drive",CR,LF
DB "/M = Minimum disk size (16K)",CR,LF
DB "/A = All of available expanded memory",CR,LF,LF

DB "Use XPANBOSS to control the XPANDISK virtual disk",CR,LF,"$"

BELL            EQU     7
CR              EQU     13
LF              EQU     10
CTRL_Z          EQU     26
SPACE           EQU     32
BOX             EQU     254
Y_SCAN          EQU     15H

DRIVE           EQU     5CH

PASSWORD                DB      "PC Magazine Productivity"
PASSWORD_LENGTH         EQU     $ - PASSWORD
PIPE                    DB      PASSWORD_LENGTH + 1 DUP (?)

DRIVE_MSG       DB      "Drive $"
ILLEGAL_MSG     DB      ": does not belong to XPANBOSS",BELL,CR,LF,"$"
WARNING_MSG1    DB      CR,LF,"WARNING: All current data of $"
WARNING_MSG2    DB      ": will be lost.",CR,LF
                DB      "Do you wish to continue?  Y/N $"
FAILED_MSG      DB      "UNSUCCESSFUL"
CRLF            DB      CR,LF,"$"

;-----------------------------------------------------------------------
MAIN            PROC    NEAR

                CLD                             ;All string moves forward.
                MOV     DX,OFFSET COPYRIGHT     ;Display copyright.
                CALL    PRINT_STRING

                MOV     BL,DS:[DRIVE]           ;Retrieve drive request.
                MOV     AL,BL                   ;Save it.
                DEC     AL                      ;Was there a drive request?
                JNS     GOT_DRIVE               ;If yes, use it.

                MOV     AH,19H                  ;Else, get default drive.
                INT     21H

GOT_DRIVE:      ADD     AL,"A"                  ;Convert to ASCII.
                MOV     DS:[DRIVE],AL                   ;Save it and
                MOV     BYTE PTR DS:[DRIVE + 1],"$"     ; convert to DOS string.
                MOV     DX,OFFSET PIPE          ;Request password from
                MOV     SI,DX                   ; block device driver.
                MOV     CX,PASSWORD_LENGTH
                MOV     AX,4404H                ;IOCTL Read from block device.
                INT     21H

                MOV     DI,OFFSET PASSWORD      ;Did device driver return
                REPZ    CMPSB                   ; required password?
                JZ      CONTINUE                ;If yes, continue.

                MOV     DX,OFFSET CRLF          ;Else, CR and LF to next line.
                CALL    PRINT_STRING
                CALL    PRINT_DRIVE             ;Print requested drive.
                MOV     DX,OFFSET ILLEGAL_MSG   ;Tell user drive does not
                CALL    PRINT_STRING            ; belong to XPANBOSS.
                JMP     SHORT ERROR_EXIT

CONTINUE:       CMP     BYTE PTR [SI],0         ;If Parameters not changed
                JZ      PARAMETERS              ; or /W, skip warning.

                CALL    WARNING                 ;Else, warn user.
                JNZ     EXIT                    ;Exit if user said no.
                MOV     DX,OFFSET CRLF          ;Else, CR, LF to next line.
                CALL    PRINT_STRING

PARAMETERS:     MOV     DX,OFFSET PASSWORD      ;Send counter password as
                MOV     CX,PASSWORD_LENGTH      ; OK to XPANDISK.
                MOV     AX,4405H                ;IOCTL Write to block device.
                INT     21H
                MOV     AL,0                    ;ERRORLEVEL = 0.
                JNC     EXIT                    ;If successful, exit.

                MOV     DX,OFFSET FAILED_MSG    ;Else, tell user it failed.
                CALL    PRINT_STRING
ERROR_EXIT:     MOV     AL,1                    ;ERRORLEVEL = 1.

EXIT:           PUSH    AX                      ;Save ERRORLEVEL.
                MOV     DX,OFFSET CRLF          ;Blank line.
                CALL    PRINT_STRING
                POP     AX                      ;Retrieve ERRORLEVEL.
                MOV     AH,4CH                  ;Exit.
                INT     21H

MAIN            ENDP

WARNING:        MOV     DX,OFFSET WARNING_MSG1  ;Display warning message.
                CALL    PRINT_STRING
                CALL    PRINT_DRIVE
                MOV     DX,OFFSET WARNING_MSG2
                CALL    PRINT_STRING

                XOR     AH,AH                   ;Get a keystroke.
                INT     16H
                CMP     AH,Y_SCAN               ;"Y" key pressed?
                JNZ     WARNING_END             ;If no, quick exit.
                MOV     AH,0EH                  ;Else, display key pressed.
                INT     10H
                XOR     AH,AH                   ;Retrieve another keystroke.
                INT     16H
                CMP     AL,CR                   ;Requires a confirming Enter.

WARNING_END:    RET

PRINT_DRIVE:    MOV     DX,OFFSET DRIVE_MSG
                CALL    PRINT_STRING
                MOV     DX,5CH                  ;Requested drive.
PRINT_STRING:   MOV     AH,9
                INT     21H
                RET

_TEXT           ENDS
                END     START
```

XPANBOSS.ASM: *The assembly language listing for XPANBOSS.COM, the program that lets you control the size of the XPANDISK virtual disk from the command prompt. XPANBOSS uses the DOS I/O control service to communicate with XPANDISK.*

determining the base (or frame) segment of the 64K expanded memory window, allocating and deallocating memory, and for transferring the application's allocated pages into the 64K window.

There is one special requirement for device drivers and TSRs. Since an expanded memory application may be running when a device driver or TSR interrupts to access the 64K expanded memory window in use, the interrupt service must save the pages currently mapped into that window before accessing those memory pages. On exit the expanded memory mapping is then restored to the way it was found. The EMM functions 8 and 9, Save Page Map and Restore Page Map, provide this service. These calls don't actually copy the data safely into a buffer for restoration at a later time, as a TSR might do with video memory. Just the expanded memory board's registers that control which pages are placed on the bus (in the 64K window) are saved and restored by the special EMM function calls.

INPUT/OUTPUT CONTROL The interesting aspect of XPANDISK, of course, is the way XPANBOSS changes the disk configuration. DOS 2.0, which provided the ability to install device drivers, also provided a means by which applications could communicate with those drivers. If you have the DOS *Technical Reference*, you may possibly have flipped through the listing of the long (38 pages) and intimidating-looking function 44h of interrupt 21h. Function 44h IOCTL (Input Output Control) is divided into numerous subfunctions that are used to pass information between applications and device drivers. Of these, subfunctions 4 and 5 read and write control strings from or to a block device, and are perfect for XPANBOSS. The control strings have meaning only to the application and driver. DOS has no interest in the packet of information; rather, it acts only as the courier in the transaction, passing the information on to the requested drive.

At least that's how it ought to be. IOCTL passes the pointers, not the actual data, to the buffer location of the control string via the DS:BX pair, with the length in CX. The buffer acts as a pipe between the two procedures and works very much like the OS/2 interprocess communication pipe of which you may have heard.

```
100 REM - BASIC PROGRAM TO CREATE XPANBOSS.COM
110 CLS:PRINT "Creating XPANBOSS.COM": OPEN "XPANBOSS.COM" AS #1 LEN = 1
120 FIELD #1, 1 AS A$: CHECKSUM#=0
130 FOR I = 1 TO    56
140  LINESUM#=0: LOCATE 2,2: PRINT "Countdown: "    56 - I ;
150  FOR J = 1 TO  16: READ BYTE$: CHECKSUM#=CHECKSUM#+VAL("&H"+BYTE$)
160   LINESUM#=LINESUM#+VAL("&H"+BYTE$)
170   IF (BYTE < 256) THEN LSET A$=CHR$(VAL("&H"+BYTE$)): PUT #1
180  NEXT J
190  READ LINETOT$: LINECHECK# = VAL("&H"+LINETOT$)
200  IF LINECHECK# = LINESUM# THEN GOTO 220
210  LOCATE 6,2: PRINT "Error in line #"  ;  260 +  10 * I: GOTO 260
220 NEXT I
230 CLOSE: READ FILETOT$ : FILECHECK# = VAL(FILETOT$)
240 IF CHECKSUM# <> FILECHECK# THEN GOTO 260
250 PRINT: PRINT "XPANBOSS.COM created successfully": SYSTEM
260 PRINT: PRINT "XPANBOSS.COM is not valid!": END
270 DATA E9, CE,  2,  D,  A, 58, 50, 41, 4E, 42, 4F, 53, 53, 20, 31, 2E,   40A
280 DATA 30, 20, 28, 43, 29, 20, 31, 39, 38, 38, 20, 5A, 69, 66, 66, 20,   3AD
290 DATA 43, 6F, 6D, 6D, 75, 6E, 69, 63, 61, 74, 69, 6F, 6E, 73, 20, 43,   62C
300 DATA 6F, 2E,  D,  A, 50, 43, 20, 4D, 61, 67, 61, 7A, 69, 6E, 65, 20,   4B3
310 DATA FE, 20, 4D, 69, 63, 68, 61, 65, 6C, 20, 4A, 2E, 20, 4D, 65, 66,   5A1
320 DATA 66, 6F, 72, 64,  D,  A,  A, 53, 79, 6E, 74, 61, 78, 3A, 20, 58,   505
330 DATA 50, 41, 4E, 42, 4F, 53, 53, 20, 5B, 64, 3A, 5D, 5B, 2F, 44, 20,   47A
340 DATA 64, 69, 73, 6B, 20, 73, 69, 7A, 65, 5D, 5B, 2F, 53, 20, 73, 65,   5B8
350 DATA 63, 74, 6F, 72, 20, 73, 69, 7A, 65, 5D, 5B, 2F, 45, 20, 65, 6E,   5B2
360 DATA 74, 72, 69, 65, 73, 5D, 5B, 2F, 57, 5D, 5B, 2F, 52, 5D, 5B, 2F,   585
370 DATA 4E, 5D, 5B, 2F, 41, 5D,  D,  A,  A, 44, 69, 73, 6B, 20, 73, 69,   49A
380 DATA 7A, 65, 20, 20, 20, 3D, 20, 28, 31, 36, 20, 2D, 20, 32, 33, 37,   334
390 DATA 36, 20, 25, 4B, 20, 62, 79, 74, 65, 73, 3A, 20, 64, 65, 66, 61,   514
400 DATA 75, 6C, 74, 20, 2D, 20, 26, 24,  D,  A, 53, 65, 63, 74, 6F, 72,   493
410 DATA 20, 73, 69, 7A, 65, 20, 3A, 20, 28, 31, 32, 38, 2C, 32, 35, 36,   3E4
420 DATA 2C, 35, 31, 32, 29, 20, 62, 79, 74, 65, 73, 3B, 20, 64, 65, 66,   4BE
430 DATA 61, 75, 6C, 74, 20, 3A, 20, 32, 35, 36,  D,  A, 65, 6E, 74, 72,   4A0
440 DATA 69, 65, 73, 20, 20, 20, 20, 20, 2E, 20, 20, 24, 20, 2D, 20, 29,   23C
450 DATA 21, 22, 29, 69, 6E, 20, 72, 6F, 6F, 74, 20, 64, 69, 72, 65, 63,   86E
460 DATA 74, 6F, 72, 79, 2E, 20, 64, 65, 66, 61, 75, 6C, 74, 20, 2E, 20,   90B
470 DATA 26, 24,  D,  A, 2F, 57, 20, 20, 20, 42, 68, 61, 6E, 67, 69, 20,   2EA
480 DATA 72, 69, 7A, 65, 20, 57, 49, 54, 48, 4F, 55, 54, 20, 61, 72, 6E,   56E
490 DATA 69, 6E, 67, 2E, 20, 57, 41, 52, 4E, 49, 4E, 47, 3A, 20, 41, 6C,   4A9
500 DATA 6C, 20, 64, 61, 74, 61, 20, 77, 69, 6C, 6C, 20, 62, 65, 20, 6C,   571
510 DATA 6F, 73, 74, 2E,  D,  A, 2F, 52, 20, 3D, 20, 52, 65, 61, 64, 2D,   442
520 DATA 6F, 6E, 6C, 79, 20, 64, 72, 69, 76, 65,  D,  A, 2F, 4D, 20, 2D,   4EC
530 DATA 20, 4D, 69, 6E, 69, 6D, 75, 6D, 20, 64, 69, 73, 6B, 20, 73, 69,   5C3
540 DATA 7A, 65, 20, 28, 31, 36, 4B, 29,  D,  A, 2F, 41, 20, 3D, 20, 41,   347
550 DATA 6C, 6C, 20, 6F, 66, 20, 41, 76, 61, 69, 6C, 61, 62, 6C, 65, 20,   58E
560 DATA 45, 78, 70, 61, 6E, 64, 65, 64, 20, 4D, 65, 6D, 6F, 72, 79,  D,   5CF
570 DATA  A,  A, 55, 73, 65, 20, 58, 50, 41, 4E, 42, 4F, 53, 53, 20, 74,   462
580 DATA 6F, 20, 63, 6F, 6E, 74, 72, 6F, 6C, 20, 74, 68, 65, 20, 58, 50,   5B9
590 DATA 41, 4E, 44, 49, 53, 4B, 20, 76, 69, 72, 74, 75, 61, 6C, 20, 64,   569
600 DATA 69, 73, 6B,  D,  A, 24, 50, 43, 20, 4D, 61, 67, 61, 7A, 69, 6E,   4FC
610 DATA 65, 20, 50, 72, 6F, 64, 75, 63, 74, 69, 76, 69, 74, 79,  0,  0,   59B
620 DATA  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,     0
630 DATA  0,  0,  0,  0,  0,  0,  0, 44, 72, 69, 76, 65, 20, 24, 3A, 20,   298
640 DATA 64, 6F, 65, 73, 20, 6E, 6F, 74, 20, 62, 65, 6C, 6F, 6E, 67, 20,   5D2
650 DATA 74, 6F, 20, 58, 50, 41, 4E, 42, 4F, 53, 53,  7,  D,  A, 24,  D,   3C0
660 DATA  A, 57, 41, 52, 4E, 49, 4E, 47, 3A, 20, 41, 6C, 6C, 20, 62, 75,   48E
670 DATA 72, 72, 65, 6E, 74, 20, 64, 61, 74, 61, 20, 6F, 66, 20, 24, 3A,   558
680 DATA 20, 77, 69, 6C, 6C, 20, 62, 65, 20, 6C, 6F, 73, 74, 2E,  D,  A,   4B6
690 DATA 44, 6F, 20, 79, 6F, 75, 20, 77, 69, 73, 68, 20, 74, 6F, 20, 63,   591
700 DATA 6F, 6E, 74, 69, 6E, 75, 65, 3F, 20, 20, 59, 2F, 4E, 20, 24, 59,   4F0
710 DATA 4E, 52, 55, 42, 42, 49, 53, 48, 46, 59, 4C,  D,  A, 24, FC, BA,   93F
720 DATA  3,  1, E8, 9C,  0, 8A, 1E, 5C,  0, 8A, C3, FE, C0, 75,  4, B4,   8D0
730 DATA 19, CD, 21,  4, 61, A2, 5C,  0, C6,  6, 5D,  6, 24, BA, 2E,  2,   482
740 DATA 8B, F2, B9, 10,  0, B8,  4, 44, CD, 21, BF, 16,  2, F3, A6, 74,   721
750 DATA 11, BA, CD,  2, E8, 6A,  0, E8, 5E,  0, BA, 4E,  2, E8, 61,  0,   605
760 DATA EB, 25, 80, 2C,  0, 74,  B, E8, 2B,  0, 75, 1E, BA, CB,  2, E8,   860
770 DATA 4F,  0, BA, 16,  2, B9, 10,  0, B8,  5, 44, CD, 21, B0,  0, 72,   985
780 DATA  0, BA, BF,  2, E8, 3A,  0, B0,  1, 50, BA, CD,  2, E8, 21,  0,   640
790 DATA 58, B4, 4C, CD, 21, BA, 6F,  2, E8, 26,  0, E8, 1A,  0, BA, 8F,   6CB
800 DATA  2, E8, 1D,  0, 32, E4, CD, 16, 80, FC, 10, 79,  A, B4,  E, CD,   6A0
810 DATA 10, 32, E4, CD, 16, 3C,  E, C3, BA, 47,  2, E8,  2,  0, BA, 6C,   61A
820 DATA  0, B4,  9, CD, 21, C3,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,   26E
830 DATA 71516
```

XPANBOSS.BAS: *Running this BASIC program creates XPANBOSS.COM, which lets you change the size of XPANDISK dynamically.*

XPANBOSS needs to pass its command-line parameters to XPANDISK so XPANDISK can change BPB (BIOS parameter block). DOS uses BPB to determine the disk's characteristics—the sector size and total sectors, for example. The target device driver's specifier (1 = A, 2 = B, 3 = C, etc.) is placed in the BL register before making the IOCTL call. The target drive is either the default or the one specified by the user on XPANBOSS's command line.

But how does XPANBOSS know if the user-requested target drive is an XPANDISK? In a word, it doesn't. Therefore, a prearranged password is first requested from the driver to see if the target drive belongs to XPANBOSS. This is done with the IOCTL subfunction 4, Read from block device. Not to divulge a national security secret, the password I selected is "PC Magazine Productivity."

DOS routes the IOCTL call to the driver. When XPANDISK gets control, it first parses the command line of XPANBOSS. (The call passes XPANDISK the DS:BX address of the pipe. DS is XPANBOSS's data segment, so XPANDISK parses offset 81h, the command-line buffer of XPANBOSS's PSP.) Along with the password, XPANDISK then returns whether or not parsing resulted in a change request to the disk. At this point no changes to XPANDISK have yet been made. If, after regaining control from the IOCTL call and validating the password, XPANBOSS finds that changes *are* to be made, the user is warned and is asked to confirm his request. If the user responds with a "Yes," XPANBOSS passes the request back to XPANDISK, this time using function 5 (Write to block device).

■ Without the use of passwords as security, an application that also used IOCTL could blindly trigger a false and disastrous XPANDISK resizing.

Again, however, we encounter a problem similar to the one XPANBOSS had identifying the target drive. This time it's simply the other way around, for XPANDISK must be sure that it is receiving an authorized request from XPANBOSS. XPANBOSS, therefore, sends a counter password; XPANDISK verifies and the changes are made. The counter password? It's the same "PC Magazine Productivity." Without the use of passwords as security, an application that also used IOCTL could blindly trigger a false and disastrous XPANDISK resizing.

A BUG IN THE BUSHES In the original design for XPANDISK, rather than reduce the size of the disk to 16K, I intended that all expanded memory be returned to the EMM pool, making even more memory available for demanding applications. Any subsequent calls to the driver's INPUT or OUTPUT sector-moving procedures (arising from a user entering DIR with a memoryless disk, for example) returned an Unknown Unit error to DOS. This worked fine. DOS thought the drive was out of commission and returned an alarming but effective message, "Fatal Error Reading Drive."

A problem arose, however, when it came time to reawaken the drive and reclaim some expanded memory. The same approach described above was taken to communicate via IOCTL. With DOS, Version 2.1, however, before it would pass XPANBOSS's IOCTL call on to XPANDISK, DOS made an INPUT call to the driver requesting a copy of the FAT sectors. A copy of the FAT? Why DOS wanted a copy of the FAT, I don't know; the FAT has nothing to do with a driver's IOCTL. XPANDISK, of course, was still asleep, and so returned the Unknown Unit error, as there was no disk and no FAT to

XPANDISK BY MODEM

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XPANDISK consists of two programs, the device driver XPANDISK.SYS and its control program, XPANBOSS.COM. Both are already compiled and ready to run. If you prefer, XPANDISK.BAS and XPANBOSS.BAS will create the necessary files when run once in BASIC. The source .ASM listings are also downloadable, but require you to use a macro assembler (IBM or Microsoft, Version 2 or later).

Photocopy this page. Trim and hole-punch the copy and add it to your DOS manual.

XPANDISK
Device

Michael J. Mefford — 1988 No. 18 (Utilities)

Purpose: Permits varying the amount of expanded memory allocated to a RAMdisk without rebooting, when used on systems equipped with memory that conforms to the Lotus/Intel/Microsoft specification.

Format: In CONFIG.SYS file:

```
DEVICE=XPANDISK.SYS [/Dn][/Sn][/En][/Mn][/An]
```

At DOS command prompt:

```
XPANBOSS [d:][/Dn][/Sn][/En][/Wn][/Rn][/Mn][/An]
```

Remarks: XPANDISK makes use of an Expanded Memory Manager. The DEVICE=XPANDISK.SYS entry must, therefore, follow the DEVICE=EMM.SYS (driver name will differ with manufacturer) line already in the CONFIG.SYS file. XPANBOSS varies the parameters of the RAMdisk *d*: created by XPANDISK. Note that while this does not require rebooting, changing parameters other than /R (Read-only) does reformat *d*:, whose contents are thereby lost. A confirmation warning is given to allow saving the RAMdisk files before the reformatting. The optional switch parameters for XPANDISK.SYS and XPANBOSS.COM are as follows:

/Dn	Disk size, variable from 16K to 32768K; default 64K.
/Sn	Sector size, 128, 256, or 512 bytes; default 265 bytes.
/En	Number of RAMdisk root directory entries; default 64.
/Mn	Minimizes RAMdisk size (to 16K); use when running large spreadsheets or databases.
/An	Expands RAMdisk to fill all extended memory.
/Wn	Eliminates warning that changing RAMdisk parameters loses contents; use in batch file operation.
/Rn	Makes RAMdisk read-only; use after loading possible Trojan horse programs. RAMdisk *d*: may be returned to read-write by entering **d**:XPANBOSS.

Note: DOS assigns the next available drive letter as d:. Be sure that this does not cause a conflict if you are using a SUBST drive.

Note: XPANDISK and XPANBOSS allow the same parameter comments permitted by the VDISK.SYS extended/conventional device driver. Thus, for example, you could enter

```
DEVICE=XPANDISK.SYS /disk size=120K /sector=128
```

and DOS would understand this as

```
DEVICE=XPANDISK.SYS /D120/S128
```

return. DOS didn't like that answer, so it returned a failed IOCTL call back to XPANBOSS.

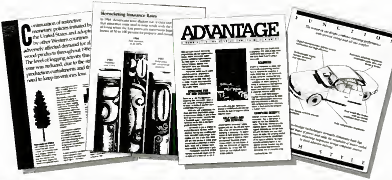
In order for XPANDISK to know it was to create a drive, XPANBOSS needed to make contact via IOCTL. But DOS would not pass the IOCTL message until it found a FAT of the yet-to-be-created drive. Thus, my zero-size-disk approach was abandoned and the 16K minimum drive was born.

DEBUGGING XPANDISK Device drivers, like TSRs, are notoriously difficult to debug because they usually have to be installed and active for you to find any lurking problems. So you can't properly debug unless installed; however, you can't load resident code under DEBUG. One classic way around this dilemma is to isolate a device driver bug by inserting a display statement in the source code at the point where you suspect the problem to be. Print information, such as the value of a register or variable, that you think may lead to resolving the bug.

> ■ Device drivers are difficult to debug because they usually have to be installed and active for you to find any problems.

In the XPANDISK assembly listing there are a few lines of code (shown in lowercase) that are commented out in the INPUT_OUTPUT procedure. This code is a remnant of XPANDISK's debugging print statements. During development a copy of the print code was inserted in each interrupt procedure to print out the command number of the procedure. That way I could see which procedures were being called by DOS and in what order they appeared.

The print code left in the listing has been modified and if you make it active, it will print out an asterisk every time the INPUT_OUTPUT procedure is called. I left it so you could observe how many sector requests were made with every disk access. Try it and count the asterisks. You'll be surprised how busy the driver is. Warning: If you do use this print technique, don't use DOS display functions 2 (Display Output) and 9 (Print String) for any of the interrupt procedures other than the INIT (initialization). To do otherwise violates the nonreentrant taboo of DOS. Instead, print via the BIOS interrupt 10h, function 0Eh (Write TTY). Note, too, that the print statement technique can be frustratingly slow and often doesn't provide enough information to solve many problems.



There is another approach that I've found effective and—more important—faster. Insert an INT 3 instruction in the code at the suspect location. Normally INT 3 points to an IRET instruction. When DEBUG loads, it points INT 3 to its break-point procedure. (Unlike other interrupt instructions that require 2 bytes to encode, INT 3 is a special interrupt encoded as the single byte, CCh. This enables a debugger to insert the break-point interrupt on top of any single-byte instruction without disturbing adjacent code.)

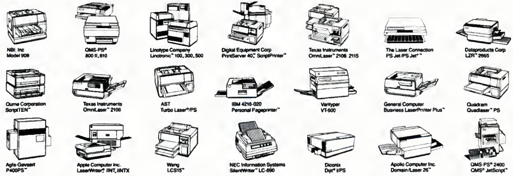
Once the driver with the embedded INT 3 is installed and DEBUG is loaded, the stage is set for debugging. The next step is to generate an interrupt to the driver to get to the INT 3. In the case of XPANDISK the inserted INT 3 was in XPANDISK's IOCTL procedure, so I loaded XPANBOSS into DEBUG and gave DEBUG the "g" (go) instruction. DEBUG executed XPANBOSS, which called DOS via IOCTL, which called XPANDISK, which tripped over the INT 3, which landed us back in DEBUG in the break-point procedure. DEBUG displayed the value of the registers and the current instruction to be executed, which is INT 3 instruction. The next instruction after the INT 3 is right in the middle of XPANDISK's resident code and is ready to be traced. (Just be sure to start tracing at the next instruction *after* the INT 3 instruction.)

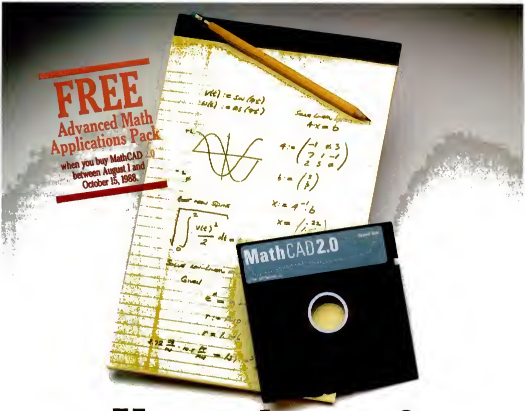
■ Having XPANBOSS on hand ensures you won't have to reboot because an application runs out of expanded memory.

XPANDISK should work fine with any expanded memory system that sticks to the EMM standard. The DOS *Technical Reference* is an invaluable source if you plan to explore device drivers further. Microsoft's monumental *MS-DOS Encyclopedia* has an excellent section (including some templates) on device drivers, written by Ray Duncan. Another excellent model is the VDISK source code, which is contained on the supplementary disk that comes with DOS 3.*x*.

While you don't need to use XPANBOSS to reap many of the benefits of XPANDISK, having it on hand ensures that you won't have to reboot because an application runs out of expanded memory. And if you haven't added an expanded memory board yet because you didn't know how you could use it, there's no reason to wait any longer.

Michael J. Mefford is a contributing editor of PC Magazine.

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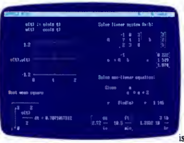

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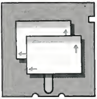

Our annual printer issue prompted a PostScript printing utility for DOS, OS/2, and dual-mode execution that also demonstrates the way to eliminate the usual FAPI overhead.

There's something about *PC Magazine*'s annual roundup of new printers that affects everyone at the magazine, and I'm no exception. Several months ago I bought a PostScript laser printer, and I've been looking forward to the chance to bring it into the OS/2 discussion ever since.

PostScript, as you may know, is a page description language, and PostScript printers are a little strange: they can recognize and interpret complex PostScript programs, but they cannot understand normal ASCII text files. If you try COPYing an ASCII file to a PostScript printer, the printer will ignore the file. Most PostScript laser printers have emulation modes (Diablo 640 or Hewlett-Packard LaserJet are common) to print ASCII files, but I preferred to leave my printer in PostScript mode and take a different approach.

Of course, solving this little problem is not the entire purpose of this issue's column. I actually have four goals: to demonstrate how to create a single dual-mode .EXE file that will run under both OS/2 and DOS without using FAPI; to discuss some of the new features in Microsoft's Macro Assembler, Version 5.1; to show you a little PostScript; and to provide you with a little utility—in OS/2, DOS, and dual-mode versions—for printing ASCII files on a PostScript printer.

FAPI AND ALTERNATIVES In the Environments column of December 8, 1987, I discussed OS/2's Family Application Program Interface (FAPI) facility. To use it, you start by writing an OS/2 program that uses a subset of the OS/2 function calls. This subset includes only those functions that can be easily translated into DOS functions.

You then run the OS/2 .EXE file through the BIND program, which is included with IBM's and Microsoft's OS/2 Programmer's Toolkits and with Microsoft's OS/2 language products. BIND embeds a DOS loader and a collection of functions that convert OS/2 calls to equivalent DOS calls into your .EXE file. When your program is run under DOS, the loader patches the program's code so that it calls these conversion functions rather than the normal OS/2 functions.

This is possible because the OS/2 .EXE file format encompasses the DOS .EXE format. An OS/2 .EXE file begins with a DOS .EXE header and (optionally) with a DOS program. The OS/2 LINK command normally inserts a small DOS program into an OS/2 .EXE file. This default DOS program simply displays the message "This program cannot be run in DOS mode" and terminates. BIND removes the default DOS program from the .EXE file and inserts the loader program and conversion functions. The resultant .EXE file runs both under OS/2 and DOS, and it is often called a "dual-mode" program.

■ You can create a single .EXE file that contains two complete programs. One program is the OS/2 version and the other is the DOS version.

(Early versions of the OS/2 LINK did not embed this little program in the .EXE file. Instead, LINK constructed the DOS header so that it generated a "Program too big to fit in memory" error when you attempted to run the .EXE under DOS.)

The big problem with using FAPI is the size of the dual-mode .EXE. Depending on which OS/2 functions you use, BIND can easily increase the size of an OS/2 .EXE file by 5K, 10K, 20K, or even more. For a small utility, this jump in size is quite distressing.

Fortunately, there is a better approach for small utilities. You can create a single .EXE file that contains two complete programs. One program is the OS/2 version and the other is the DOS version. The dual-mode .EXE file is approximately the combined size of the OS/2 and DOS versions by themselves.

Here's how you do it: when you run LINK to create an OS/2 .EXE file, you can optionally specify a "module definition file" as the last Link parameter. By convention, a module definition file is given a .DEF extension. The format of the .DEF file is described in the IBM *OS/2 Technical Reference* and in the documentation included with Microsoft's OS/2 languages.

One statement in the module definition

file is called STUB. You use this statement to specify a DOS .EXE file that LINK embeds in the OS/2 .EXE file. This can be a little DOS program similar to the one LINK uses, but one whose message gives the user more information about running the program. Or it can be a full DOS version of the OS/2 program you're creating.

If you're writing a new OS/2 utility and are using only OS/2 functions that have DOS equivalents, it's relatively easy to create separate DOS and OS/2 versions. The source code for the OS/2 version will call OS/2 functions. OS/2 functions are coded as far (intersegment) calls, with the parameters pushed on the stack. For the DOS version of the utility, you use that same module, but you also write another module with functions whose names are those of the OS/2 functions. These functions retrieve the parameters from the stack and use them to make the DOS calls.

This may seem a little confusing at first, so let's look at an example.

THE FILES Figures 1 through 7 show the various files used to create a program called ASC2PS, which is an ASCII-to-PostScript filter. The program reads an ASCII file from standard input and writes PostScript to standard output. Using these seven files, you can create an OS/2-only version called ASC2PSO.EXE; a DOS-only version called ASC2PSD.EXE; or a dual-mode version called ASC2PS.EXE.

The bulk of the source code for the program is contained in ASC2PS.ASM (as shown in Figure 1). It makes use of three OS/2 functions: DosRead, DosWrite, and DosExit. These three OS/2 functions can be converted into their DOS equivalents rather simply: that's the job of DOSFUNC.ASM (Figure 2). You need DOSFUNC.ASM only if you are creating the DOS-only version or the dual-mode version of ASC2PS.

Figures 3 and 4 contain two module definition files: ASC2PSO.DEF, for the OS/2-only version; and ASC2PS.DEF, for the dual-mode version. You don't use a module definition file for creating the DOS-only version. Figures 5 through 7 are three make files to create the OS/2-only, DOS-only, and dual-mode versions.

To create any of the three versions of ASC2PS, you need three of the programs in the Microsoft Macro Assembler 5.1 package: MASM.EXE, LINK.EXE, and MAKE.EXE. Since MASM, LINK, and MAKE are all FAPI programs, you can run them under OS/2, or under the OS/2 DOS Compatibility Mode, or under DOS itself. (Note that MASM 5.1 comes with two versions of LINK.EXE. Be sure to use the one that identifies itself as the "Segmented-Executable Linker.")

If you're creating the OS/2-only or the dual-mode version, you'll also need the DOSCALLS.LIB import library. Your LIB environment variable should point to the directory where DOSCALLS.LIB is stored.

If you want to create the OS/2-only version, you need ASC2PS.ASM, ASC2PSO.DEF, and the ASC2PSO make file. Enter the command

```
MAKE ASC2PSO
```

This will create the ASC2PSO.EXE file. This is a normal way to create an OS/2 program.

If you want to create the DOS-only version, you need ASC2PS.ASM, DOSFUNC.ASM, and the ASC2PSD make file. Enter

```
MAKE ASC2PSD
```

MAKE will create ASC2PSD.EXE. In this case, the ASC2PS.ASM module looks as if it's calling OS/2 functions, but these functions are in DOSFUNC.ASM, and they make DOS calls.

If you want to create the dual-mode version, you need ASC2PS.ASM, DOSFUNC.ASM, ASC2PS.DEF, and the ASC2PS make file. Use the command

```
MAKE ASC2PS
```

This creates ASC2PS.EXE (the dual-mode version) and ASC2PSD.EXE (the DOS-only version) as a by-product. The ASC2PSD.EXE program is also embedded in the ASC2PS.EXE file.

USING THE PROGRAM In all three of its versions, ASC2PS is a filter or pipe program. It reads an ASCII file through standard input and writes a PostScript file to standard output. To print an ASCII file on a PostScript printer connected to the first printer port, you would use

```
ASC2PS <Ascii-file >LPT1
```

You can also direct the input to be saved in a file.

```
ASC2PS <Ascii-file >PostScript-file
```

```
;----------------------------------------------------------------
; ASC2PS.ASM -- ASCII to PostScript Pipe Program
;               PC Magazine * Charles Petzold, 7/88
;               Copyright (c) 1988, Ziff Communications Co.
;----------------------------------------------------------------

                EXTRN DosRead:FAR, DosWrite:FAR, DosExit:FAR

                IFDEF DOSVERSION
                        PushI   MACRO Value
                                Mov     AX, Value
                                Push    AX
                                ENDM
                ELSE
                        .286
                        PushI   MACRO Value
                                Push    Value
                                ENDM
                ENDIF

                DOSSEG
                .MODEL  SMALL, PASCAL
                .STACK  4096

;--------------------------------------------
; Entry point of program and main processing
;--------------------------------------------

                .DATA?

AsciiBuffer     db      200 dup (?)

                .CODE

Entry           PROC
                LOCAL   LineNum:WORD, ColNum:WORD

                IFDEF DOSVERSION
                        Mov     AX, DGROUP      ; For DOS, set DS to
                        Mov     DS, AX          ;   DGROUP segment
                ENDIF

                Push    DS                      ; Set ES to DS
                Pop     ES

GetNextLine:    Mov     DI, Offset AsciiBuffer  ; Point DI to buffer beginning
                Mov     ColNum, 0               ; Initialize to 1st column

GetNextChar:    Call    getchar                 ; Get a character from SI

                Cmp     AX, -1                  ; Check if end of file
                Jns     HaveValidData           ; If not, continue
                Jmp     EndOfData               ; If so, time to clean up

HaveValidData:  Cmp     AL, 9                   ; Check if tab character
                Jb      GetNextChar             ; If below, ignore it
```

(continues)

Figure 1: *ASC2PS.ASM, the main source code file, makes use of three OS/2 functions: DosRead, DosWrite, and DosExit.*

```
                Je      TabChar                 ; Otherwise, process it

                Cmp     AL, 10                  ; Check if line feed
                Je      LineFeed                ; If so, process it

                Cmp     AL, 12                  ; Check if form feed
                Je      EndOfPage               ; If so, process it
                Cmp     AL, ' '                 ; Check if space
                Jb      GetNextChar             ; If below, ignore character

                Cmp     AL, 127                 ; Check if high order
                Jb      NormalChar              ; If not, process character
                Mov     AL, ' '                 ; Otherwise set to space
                Jmp     NormalChar              ; And process it

TabChar:        Mov     AL, ' '                 ; For tabs, store a space
                Stosb
                Inc     ColNum                  ; Until column number is
                Test    ColNum, 7               ;   increment of 8
                Jne     TabChar
                Jmp     TestEndOfLine           ; Now check for end of line

LineFeed:       Sub     AL, AL                  ; Mark end of line
                Stosb                           ;   with zero

PrintLine:      PushI   <Offset AsciiBuffer>    ; Address of buffer
                PushI   LineNum                 ; Text line number
                Call    LineOut                 ; Output the line
                Mov     LineNum, AX             ; Get new line number
                Jmp     GetNextLine             ; And do the next line

EndOfPage:      Sub     AL, AL                  ; Mark end of line
                Stosb                           ;   with zero
                PushI   <Offset AsciiBuffer>    ; Address of buffer
                PushI   LineNum                 ; Next line number
                Call    LineOut                 ; Output the line

                Mov     [AsciiBuffer], 0        ; Make a blank line
                Mov     LineNum, 65             ; Set line number to bottom

                Jmp     PrintLine               ; And continue for new page

NormalChar:     Cmp     AL, '('                 ; Check for left paren,
                Je      Special
                Cmp     AL, ')'                 ;   right paren,
                Je      Special
                Cmp     AL, '\'                 ;   or back slash.
                Jne     NotSpecial

Special:        Mov     AH, AL                  ; Save the character
                Mov     AL, '\'                 ; Store a backslash
                Stosb
                Mov     AL, AH                  ; Now get back real character

NotSpecial:     Stosb                           ; Store the character
                Inc     ColNum                  ; Bump up the column counter

TestEndOfLine:  Cmp     ColNum, 80              ; Check for 80 columns
                Jz      LineFeed                ; If so, do a new line
                Jmp     GetNextChar             ; And get the next character

EndOfData:      Cmp     ColNum, 0               ; See if anything in line
                Jnz     DumpTheLine             ; If so, must print it

                Cmp     LineNum, 0              ; See if anything on page
                Jnz     DumpThePage             ; If so, must print it
                Jz      ExitProgram             ; Otherwise, get out fast

DumpTheLine:    Sub     AL, AL                  ; Mark end of line with zero
                Stosb
                PushI   <Offset AsciiBuffer>    ; Address of buffer
                PushI   LineNum                 ; Text line number
                Call    LineOut                 ; Output the line

DumpThePage:    Mov     [AsciiBuffer], 0        ; Make a blank line
                Mov     LineNum, 65             ; Set to bottom of page

                PushI   <Offset AsciiBuffer>    ; Address of buffer
                PushI   LineNum                 ; Text line number
                Call    LineOut                 ; Output the line

ExitProgram:    PushI   1                       ; Terminate all threads
                PushI   0                       ; Return code
                Call    DosExit                 ; Terminate

Entry           ENDP

;-----------------------------------------------------------------
; LineOut -- Converts ASCII line to PostScript, returns new LineNum
;-----------------------------------------------------------------

                .DATA?

PsBuffer        db      200 dup (?)

                .DATA

PsTransScale    db      "36 36 translate .9375 .9091 scale", 0
PsSetFont       db      "/Courier findfont 12 scalefont setfont", 0
PsMoveTo1       db      "0 ", 0
PsMoveTo2       db      " moveto", 0
PsShow1         db      " (", 0
PsShow2         db      ") show", 0
PsShowPage      db      "showpage", 0

                .CODE

LineOut         PROC    USES DX AX, String:PTR BYTE, LineNum:WORD

                Mov     DX, LineNum             ; Set DX to line number
                Or      AX, DX                  ; If zero, skip some stuff
                Jnz     PrintLine

                PushI   <Offset PsTransScale>   ; Output initialization string
                Call    puts

                PushI   <Offset PsSetFont>      ; Output setfont code
                Call    puts
```

```
PrintLine:      Mov     AX, String              ; Address of line buffer
                Cmp     Byte Ptr [AX], 0        ; See if blank line
                Je      CheckEndPage            ; If so, check for last line

                PushI   <Offset PsBuffer>       ; Copy PsMoveTo1 string to
                PushI   <Offset PsMoveTo1>      ;   PsBuffer area
                Call    strcpy

                Mov     BX, Offset PsBuffer     ; Find length of PsBuffer
                Push    BX
                Call    strlen
                Add     AX, BX                  ; Points to end of PsBuffer

                Mov     AL, 12                  ; Vertical points per line
                Mul     DL                      ; Multiply by line number
                Sub     AX, 780                 ; Subtract 780
                Neg     AX                      ; Negate to measure from top

                Push    AX                      ; Number to convert
                Push    BX                      ; Area to receive ASCII value
                Call    itoa10                  ; Convert the number

                PushI   <Offset PsBuffer>       ; Append the PsMoveTo2 string
                PushI   <Offset PsMoveTo2>      ;   to PsBuffer
                Call    strcat

                PushI   <Offset PsBuffer>       ; Append the PsShow1 string
                PushI   <Offset PsShow1>        ;   to PsBuffer
                Call    strcat

                PushI   <Offset PsBuffer>       ; Append the input string
                PushI   String                  ;   to PsBuffer
                Call    strcat

                PushI   <Offset PsBuffer>       ; Append the PsShow2 string
                PushI   <Offset PsShow2>        ;   to PsBuffer
                Call    strcat

                PushI   <Offset PsBuffer>       ; Output PsBuffer
                Call    puts

CheckEndPage:   Inc     DX                      ; Increment line counter
                Cmp     DX, 66                  ; Check if end of page
                Jb      Return                  ; If so, get out

                PushI   <Offset PsShowPage>     ; Output PsShowPage string
                Call    puts

                Sub     DX, DX                  ; Set new line counter to 0
Return:         Mov     AX, DX                  ; Return new line counter
                Ret

LineGet         ENDP

;-------------------------------------------------------------------------
; getchar -- Gets 1 character from standard input, returns -1 if no more data
;-------------------------------------------------------------------------

                .DATA?

GetCharBuffer   db      6096 dup (?)
GetCharBufSize  equ     $ - GetCharBuffer

                .DATA

GetCharPtr      dw      GetCharBuffer
GetCharEnd      dw      GetCharBuffer

                .CODE

getchar         PROC    USES AX
                LOCAL   BytesRead:WORD

                Mov     BX, GetCharPtr          ; See if point to buffer
                Cmp     BX, GetCharEnd          ; Is at the end
                Jb      GetNextChar             ; If not, get next character

                PushI   0                       ; Standard output handle
                Push    DS                      ; Address of buffer for data
                PushI   <Offset GetCharBuffer>
                PushI   GetCharBufSize          ; Size of input buffer
                Push    SS                      ; Address to receive bytes
                Lea     AX, BytesRead           ;   read value
                Push    AX
                Call    DosRead                 ; Read input

                Or      AX, AX                  ; Check for error return
                Jns     NoMoreData              ; If error, read no more

                Cmp     BytesRead, 0            ; Check if bytes read is 0
                Je      NoMoreData              ; If so, read no more

                Mov     AX, Offset GetCharBuffer        ; Address of buffer
                Mov     GetCharPtr, AX          ; save it
                Add     AX, BytesRead           ; Add number of bytes
                Mov     GetCharEnd, AX          ; save it as end of buffer

GetNextChar:    Mov     BX, GetCharPtr          ; Current pointer to buffer
                Mov     AL, [BX]                ; Get the character there
                Inc     BX                      ; Increment the pointer
                Mov     GetCharPtr, BX          ; Save it
                Jmp     Short Return            ; And return
NoMoreData:     Mov     AX, -1                  ; Set error code for return
Return:         Ret

getchar         ENDP

;-------------------------------------------------------------
; puts -- Writes 0-terminated string as line to standard output
;-------------------------------------------------------------

                .DATA

CrLf            db      13, 10

                .CODE
puts            PROC    USES CX, PutsBuffer:PTR BYTE
```

(Figure 1 continues)

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CIRCLE 481 ON READER SERVICE CARD

```
                LOCAL   BytesWritteo:WORD

                PushI   PutsBuffer              ; Pind length of line
                Call    strien
                Mov     CS, AX                  ; Set that to CS

                PushI   1                       ; Standerd output handle
                Push    DS                      ; Address of output buffer
                Push    PutsBuffer
                Push    Ce                      ; Length nf buffer
                Push    SS                      ; Address for bytes written
                Les     AX, BytesWritten
                Push    AX
                Cali    DosWrite                ; Write to etandard output

                Dr      AX, AX                  ; Check for error return
                Jos     Srror                   ; If error, leave

                Cmp     BytesWrltten, CS        ; See if all bytes writteo
                Jne     Srror                   ; If not, ieeve

                PushI   1                       ; Standard output bendie
                Push    DS                      ; Address nf output buffer
                PushI   <Dffset crLf>
                PushI   2                       ; Length of buffer
                Push    SS                      ; Address nf bytes wrltteo
                Les     AX, BytesWrltten
                Push    AX
                Cail    DosWrite                ; Wrlte to steodard output

                Or      AX, AX                  ; Check for error returo
                Js      Return                  ; If no error, normal esit

                Cmp     Byteseritten, 2         ; See if all bytes written
                Je      Returo                  ; If so, oormal eeit

Srror:          Mov     AX, I                   ; Retorn error code
Return:         Ret

puts            ENDP

;-------------------------------------------------
; strlen -- Finds length Df S-terminsted string
;-------------------------------------------------

                .CODS

strleo          PROC    USES SS DI CX, Striog:PTR BYTE

                Push    DS                      ; Set ES tn DS
                Pop     SS

                Mov     DI, String              ; Address nf string
                Mov     CS, -1                  ; Initlsllse CX
                Sub     AL, AL                  ; Search for $
                Repnz   Bcsab                   ; Do the search
                Mov     AX, CS                  ; New CS
                Not     AX                      ; Plip the blts
                Dec     AX                      ; Decremented velse ie length
                Ret

strlso          SRDP

;------------------------------------------
; strcpy -- Copies Srcetring to Ostetriog
;------------------------------------------

                .CODS

etrcpy          PROC    USSS ES SI DI, DetStrlng:PTR SYTE, SrcString:PTR SYTE

                Push    DS
                Pop     ES
                Mov     SI, SrcStrlng           ; Source etring
                Mov     DI, DetStrlmg           ; Destisetion String

TryAnother:     Lodsb                           ; Get byte
                Stosb                           ; Store bytee
                Or      AL, AL                  ; See if byte wae sero
                Je      AllDone                 ; If so, we're done
                Jmp     TryAnother              ; Otherwise, loop around

AliDooe:        Mov     AX, DstString           ; Retorn ptr to destisetioo
                Ret

strcpy          ENDP

;------------------------------------------------------
; strcat -- Concstenates SrcStrlng to end of DstString
;------------------------------------------------------

                .CODS

strcet          PROC    USSS BX, DetStrlog:PTR SYTE, SrcStrimg:PTR SYTE

                Mov     AX, DetStrlng           ; Pind length of destisetlon
                Pueb    SS
                Csil    strlen

                Add     BX, AX                  ; Pind ptr beyond oid string
                Push    SS
                PuehI   SrcString
                Cell    strcpy                  ; Copy the new etring

                Ret

strcst          ENOP

;--------------------------------------------------------
; itoaiS -- Converte Number to ASCII and etoree in String
;--------------------------------------------------------

                .CODS

ltoaiS          PROC    USES ES DI DS CS SS, Sumber:WORD, Strlng:PTR SYTE

                Push    DS
                Pop     ES

                Mov     AX, Number              ; Number tn convert
                Mov     DI, Strlog              ; Destlnstlon of ASCII
                Mov     SS, iS                  ; Divisor
                Sub     CS, CS                  ; Dlglt counter

DlvLoop:        Sub     DS, DS                  ; Convert AX tn DX:AX DWord
                Div     BX                      ; Divide by 1S
                Push    DS                      ; Push the quotlent on stack
                Inc     CX                      ; Increment counter
                Or      AX, AX                  ; See if left with zero
                Jns     DlvLoop                 ; If not, continue

PutLoop:        Pop     AX                      ; Get quotlents from stack
                Add     AL, 'S'                 ; Convert to ASCII
                Stosb                           ; Store in DI
                Loop    PutLoop                 ; And continue

                Sub     AL, AL                  ; Terminate with S
                Stosb

                Mov     AX, Striog              ; Retorn address of etrlng
                Ret

ltosiS          ENDP
                ESD     Entry
```

(Figure 1 ends)

```
;----------------------------------------------------------------------
; DOSFUNC.AXM -- Assembly Language Routlnea to Convert DosWrlte, DosSead,
;                       and Dosesit to DOS calls.
;                  PC Magazine • Charles Petzold, 7/88
;                  Copyright (C) 1988, Siff Communlcatlons Co.
;----------------------------------------------------------------------

                DOSSEG
                .MODEL  LARGE, PASCAL

;-------------------------------------------
; DosRead (Sandle, &Buffer, Count, &BytesRead)
;-------------------------------------------

                .CODE
                PUBLIC  DosResS

Dosseed         PROC USRs BS CS DX DS,  \
                Sandie:WORD, Buffer:PTR BYTE, Count:WORD, BytesRead:PTR SYTE

                Lds     Ds, Suffer              ; Suffer for data
                Mov     CS, Count               ; Number of bytes to read
                Mov     BX, Handle              ; Sandis
                Mov     AH, 3Fh                 ; DOS functioo cail
                Int     21h

                Jc      Piolsh                  ; If error, get out

                Lds     SX, SytasRead           ; Get bytes read pointer
                Mov     [S0], AX                ; Store bytes raad io there
                Sub     AX, AX                  ; Ret AX for no error
Finish:         Ret

DosRead         ENDP

;------------------------------------------
; DosWrite (Sandle, &Buffer, Cnont, &Wrltten)
;------------------------------------------

                .CODE
                PUBLIC  DosWrlte

DosWrite        PROC USES BX CS DX DS,  \
                Bandle:WORD, Buffer:PTR SYTE, Count:WORD, Wrltten:PTR SYTE

                Lds     DX, Buffer              ; Buffer with date
                Mov     CX, Cnont               ; Number nf bytes to wrlte
                Mov     AX, Bandie              ; Sandle
                Mov     AX, 48h                 ; DOS function call
                Iot     21h

                Jc      Finish                  ; If error, get out

                Lds     BX, Writtee             ; Get bytes wrltten poiater
                Mov     [BX], AX                ; Store bytes wrlttee le there
                Sub     AX, AX                  ; set AX for no error
Finish:         Ret

DosWrlte        ENDP

;-------------------------------
; DosExit (TermThreade, ExitCode)
;-------------------------------

                .CODE
                PUBLIC  DosExit

DosExit         PROC TermThreads:WORD, ExitCode:WORD

18ENVF2.XYW             p. 2 of 2

                Mov     AX, ExitCode            ; Get exit code from stack
                Mov     AX, 4Ch                 ; DOS functloe cail
                Int     21h

DosSalt         ENDP
                END
```

Figure 2: *The DOSFUNC.ASM module that converts the three OS/2 functions, cited in Figure 1, to DOS calls.*

```
;-------------------------------------------------------
; ASC2PSO.DEF module definition file for OS/2-only version
;-------------------------------------------------------

NAME               ASC2PSO              WINDOWCOMPAT

DESCRIPTION        'Ascii to Postscript (C) 1988, Ziff-Communications Co.'
PROTMODE
```

Figure 3: *The ASC2PSO.DEF module definition file for the OS/2-only version.*

```
;-----------------------------------------------------------------
; ASC2PS.DEF module definition file for OS/2 and DOS dual-mode version
;-----------------------------------------------------------------

NAME               ASC2PS               WINDOWCOMPAT

DESCRIPTION        'Ascii to Postscript (C) 1988, Ziff-Communications Co.'
PROTMODE
STUB               'ASC2PSD.EXE'
```

Figure 4: *The ASC2PS.DEF module definition file for the dual-mode version.*

```
#---------------------------------------------
# ASC2PSO.OS2 make file for OS/2-only version
#---------------------------------------------

asc2pso.obj : asc2ps.asm
        masm asc2ps, asc2pso ;

asc2pso.exe : asc2pso.obj asc2ps.def
        link asc2pso, /align:16, NUL, doscalls, asc2pso.def
```

Figure 5: *The ASC2PSO make file for the OS/2-only version.*

```
#----------------------------------------
# ASC2PSD make file for DOS-only version
#----------------------------------------

asc2psd.obj : asc2ps.asm
        masm asc2ps, asc2psd /DDOSVERSION=1 ;

dosfunc.obj : dosfunc.asm
        masm dosfunc ;

asc2psd.exe : asc2psd.obj dosfunc.obj
        link asc2psd dosfunc ;
```

Figure 6: *The ASC2PSD make file for the DOS-only version.*

You can then COPY the file to a printer port or print it using the PRINT command.

Because ASC2PS reads from standard input, you can pipe output from another program into it. For example, suppose you wanted to print a directory listing on a PostScript printer connected to LPT1. You would use

```
DIR | ASC2PS >LPT1
```

THE .EXE FILE SIZES The file sizes of these three executables are worth noticing:

```
ASC2PSO.EXE:    1085
ASC2PSD.EXE:    1390
ASC2PS.EXE:     2493
```

The fact that the DOS-only version is larger than the OS/2-only version may come as a surprise to some DOS programmers, who often assume that OS/2 programs are inherently bigger than DOS programs. There are several reasons why the OS/2 version is smaller.

First, ASC2PSO.EXE, the OS/2-only version, uses an efficient "push immediate" instruction that is not available on the 8088 processor. (A DOS program *could* use a push immediate instruction, but then the program would not run on an 8088 machine.) Second, the OS/2 version calls OS/2 functions directly. The DOS version, on the other hand, contains additional functions (in the DOSFUNC.ASM module) that convert these calls to their DOS equivalents. And finally, for this particular program, the OS/2 .EXE files are more efficiently organized than the DOS .EXE file. Do a hex dump, and you'll see.

As an experiment, you can run ASC2PSO (the OS/2-only version) through BIND to convert it into a dual-mode program. You'll need API.LIB (included with Microsoft MASM 5.1) to do this. The command

```
BIND ASC2PSO DOSCALLS.LIB API.LIB
```

creates an ASC2PSO.EXE file that is 10,173 bytes long. That's quite a difference from the 2,493-byte dual-mode program we previously created. This suggests that our alternative approach is preferable for utilities of 8K or less.

MODULE DEFINITION FILES ASC2PSO.DEF and ASC2PS.DEF are module definition files. The use of the .DEF file was introduced a few years ago for *Microsoft Windows* programming and has been carried over into OS/2.

The primary purpose of a module definition file is to define certain characteristics of a program's code and data segments. For example, suppose a program consists of several code segments. Some of these code segments are used quite a lot by the program, while others are used much less frequently. In the module definition file, the programmer would designate the former code segments as PRELOAD, which means that OS/2 loads the segments when the program begins execution. He would designate the others as LOADONCALL, which means that OS/2 won't load the code segment into memory until it's needed.

The module definition file also performs a number of other, miscellaneous chores. For example, the NAME statement gives the program a module name (usually it is the same as the name of the executable file), and it can designate the program as WINDOWCOMPAT, which

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```
#---------------------------------------------------
# ASC2PS make file for OS/2 and DOS dual-mode version
#---------------------------------------------------

asc2pso.obj : asc2ps.asm
        masm asc2ps, asc2pso ;

asc2psd.obj : asc2ps.asm
        masm asc2ps, asc2psd /DDOSVERSION=1 ;

dosfunc.obj : dosfunc.asm
        masm dosfunc ;

asc2psd.exe : asc2psd.obj dosfunc.obj
        link asc2psd dosfunc ;

asc2ps.exe : asc2pso.obj asc2psd.exe asc2ps.def
        link asc2pso, asc2ps /align:16, NUL, doscalls, asc2ps ;
```

Figure 7: *The ASC2PS make file for the dual-mode version.*

means that it will run in a window in the OS/2 Presentation Manager. Moreover, any text following DESCRIPTION is embedded by LINK in the .EXE file. This is a good place for a copyright notice.

In the present case, we're using the module definition file primarily to take advantage of the STUB statement. The ASC2PS.DEF file (used to create the dual-mode version) lists ASC2PSD.EXE (the DOS-only version) as the STUB program. This is how we get the DOS program into the ASC2PS.EXE file. The ASC2PSO.DEF file has no STUB statement, so LINK uses the default stub program, which displays the message "This program cannot be run in DOS mode" and terminates.

THE NEW PROC STATEMENT Over the past few years, assembly language has lost its dominance as the primary language for application programming on the PC. At one time, most applications for small computers were written in assembly language; now, however, they are often written in high-level languages such as C. Assembly language is used today principally for high-speed subroutines. This trend is likely to continue. As application programs become larger and more sophisticated, assembly language simply becomes impractical to use.

It is interesting to see the way that Microsoft's Macro Assembler has evolved to reflect this trend. The current version, MASM 5.1, has an enhanced PROC statement that facilitates the use of assembly language with high-level languages.

As you can see, the PROC statements in ASC2PS.ASM and DOSFUNC.ASM list the function parameters by name. MASM 5.1 generates text macros that let you use these names to reference the parameters on the stack. The assembler generates entry and exit code that saves BP and sets BP equal to SP for accessing these parameters. The USES keyword following the PROC statement directs the assembler to generate code to save one or more registers on the stack and restore them on exit.

■ One of the benefits of programming for OS/2 in assembly language is that you can take full advantage of the 80286 instruction set.

A LOCAL statement can follow the PROC statement. This generates code to reserve space on the stack for local variables. The assembler creates text macros that you can use to reference these variables. You can even store structures as local variables in stack space. This ability makes it very easy to write assembly language routines that are structured similarly

to functions in high-level languages.

You'll notice that ASC2PS.ASM has functions with names such as `getchar`, `strlen`, and `puts`. These, of course, are the names of normal C library functions. These days I find myself conceptualizing the structure of a program in terms of high-level language facilities, so it's quite natural to use functions such as these, even if the entire program is written in assembly language!

PUSH IMMEDIATE The bulk of the source code in ASC2PS.ASM is the same for the OS/2 and DOS versions. However, one of the benefits of programming for OS/2 in assembly language is that you can take full advantage of the 80286 instruction set, since you don't have to worry that the program will be run on an 8088 machine.

One very useful 80286 instruction is push immediate. For example, you can use

```
Push 0
```

or

```
Push Offset Buffer
```

By contrast, when programming for the 8088 you would use

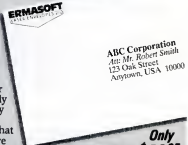
```
Mov  AX, 0
Push AX
```

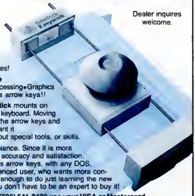
or

```
Mov  AX, Offset Buffer
Push AX
```

In order to use the push immediate instruction in the OS/2 version of ASC2PS but not in the DOS version, I've made use of an identifier I called DOSVERSION. This identifier is defined at the time that MASM is run in the make files whenever a DOS version is to be generated. At the top of ASC2PS.ASM, one of two different versions of a macro called PushI (push immediate) is defined depending on the definition of DOSVERSION.

DOSVERSION is also used in the Entry procedure soon after the program begins execution. When an OS/2 program begins execution, the DS register is set to the program's data segment. For the DOS version, DS is set to the Program Segment Prefix (PSP) and must be explicitly set to the data segment.





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WHAT, NO OS/2 MACROS? In last issue's column, I discussed how the macros included with Microsoft's MASM 5.1 can simplify the calling of OS/2 functions. I wanted to use them for this program, but I encountered some problems.

First, the macros assume that DS is equal to SS. This is definitely the case when either the ASC2PS.EXE or ASC2PSO.EXE program is run under OS/2, but it is not so when either ASC2PS.EXE or ASC2PSD.EXE is run under DOS. (Because this is contrary to the documentation, it looks like a bug.)

Secondly, I had problems when I tried to use the text macros generated by the PROC and LOCAL statements with the OS/2 function call macros. The documentation for the OS/2 macros is not very thorough in discussing how various forms of addresses can be used with the macros, so perhaps these problems will be resolved with better documentation.

At any rate, this program does not make much use of OS/2 functions, so it was easy enough to do manual PUSHes.

A LITTLE POSTSCRIPT ASC2PS essentially writes a PostScript program based on an ASCII text file. Although you can write PostScript programs yourself, most PostScript code is generated by other programs like this one.

The generation of PostScript code in ASC2PS is confined to the LineOut function. This function accepts an ASCII text line (of 80 characters or less), translates it to PostScript, and writes the PostScript to standard output. You can examine this PostScript output by simply redirecting ASC2PS output to a file.

At the start of each page, LineOut defines the font it will use. This makes use of three PostScript commands: `findfont`, `scalefont`, and `setfont` in the form

```
/Courier findfont 12 scalefont setfont
```

You'll note from this example that PostScript uses a *postfix* notation, which means that an argument precedes the function. Thus, `findfont` finds the font called Courier, `scalefont` scales that font to 12 points (that is 12/72 inch high), and `set–font` uses that font as the current one.

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```
x y moveto
```

The *x* and *y* arguments are real numbers. By default, PostScript's coordinate system has an origin at the bottom-left corner of the page. Values of *x* increase to the right; values of *y* increase going up the page. The default units are 1/72nd of an inch, which is approximately equal to a printer's point size.

To display text beginning at the current position, you use the show command following the text in parentheses:

```
(my text) show
```

You mark the end of a page using

```
showpage
```

The printer then prints the page.

ASC2PS uses two other PostScript commands: `scale` and `translate`. I wanted to display 66 80-character lines on a page. Using a normal 12-point Courier font, this text would require a printing area 8 inches wide and 11 inches high. However, most laser printers cannot print to the edge of a page. Therefore, I decided to play it safe and leave a ½-inch margin on each side of the page.

Thus I had to fit an 8-inch-wide and 11-inch-high block of text in an area 7½ inches wide and 10 inches high. I also wanted to use an origin that was at the lower-left corner of my printing area, not the lower-left corner of the page. The `translate` command takes care of the second requirement.

```
36 36 translate
```

This sets the origin at 36/72 inch to the right and 36/72 inch above the lower-left corner. The `scale` command takes care of the first job.

```
.9375 .9091 scale
```

The value .9375 is 7.5 divided by 8, and .9091 is 10 divided by 11.

THE PM DIFFERENCE I don't expect ASC2PS to be useful in OS/2 for very long. When a PostScript driver for the Presentation Manager becomes available, then you will be able to print an ASCII file on a PostScript printer simply by selecting the Print command from the File Manager menu. The PostScript driver will handle the conversion.

That takes some of the fun out of it, of course, but it also means that the Presentation Manager programs will be able to draw graphics and display various fonts on a PostScript printer without generating their own PostScript code. All in all, I look forward to that day.

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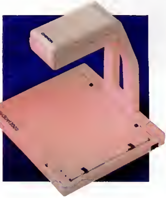

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■ POWER PROGRAMMING ■ RAY DUNCAN

STRING HANDLING IN C AND MASM

Here's how to zero in on the most useful of C's string-handling functions. You can duplicate these in assembler with routines you'll want to include in your Power Programming library.

Over the past few months, we've taken a look at conversion of numbers, qualifying of filenames, and the input and display of times and dates. Important as these building blocks are, however, they hardly suffice for the development of real-world applications. A program that can't handle the input and output of free-form text is a sorry program indeed. In this issue, therefore, we begin an exploration into the processing, searching, and sorting of strings that will span the next several installments.

STRING HANDLING IN C Text strings are declared in C source code with double-quote marks, thus:

```
"This is a string"
```

As we have discussed previously, you can denote control characters in text strings with special escape sequences, such as \t for a tab or \n for a new line (carriage return and line feed). You can also insert any arbitrary control code into a string by specifying its octal or hex value, using the escape sequence forms *\nnn* or *\xnnn*, respectively.

The C compiler translates quoted strings into a sequence of ASCII character codes terminated by a zero (null) byte. Such strings are sometimes referred to as ASCIIZ strings. For symmetry, the C runtime library functions that perform string input and output generally deal in ASCIIZ strings, too. Thus, the `gets()` function reads a line from the keyboard and places it in the calling program's buffer as an ASCIIZ string, for example.

Strings in hand, the C programmer has an extravagant array of standard library functions for string processing at his disposal. The selection is so wide, in fact, that it crosses over the hazy boundary between being rich and powerful and being intimidating and confusing. The Microsoft C 5.1 runtime library, for example, provides over 30 functions for string manipulation. And that's not even counting the formatting and conversion functions (`scanf`, `printf`, `atol`, `ltoa`, and so forth), the functions oriented toward paths and filenames, and the 20-odd functions that test and translate single characters.

The C string functions fall into two basic families: `strxxx` functions and `memxxx` functions. The `strxxx` functions are oriented toward use with typical C null-terminated (ASCIIZ) strings. The `memxxx` functions accept a count as one of their arguments and can be used on any sequence of bytes (not just ASCII characters); they ignore the final null byte of an ASCIIZ string. There is also a subgroup `strxxx`, identified by names of the form `strnxxx`, that have a hybrid character: they terminate on null bytes, but they also take a limiting count as an argument.

■ When the C string functions are organized by the job they do, you can clearly see the tremendous amount of overlap and duplication.

It's best to group the C string functions by the job they do, as shown in Figure 1. (For a detailed explanation of each function, refer to your C compiler's runtime library manual.) When they are organized in this way, you can clearly see the tremendous amount of overlap and duplication of function that exists in the current C library. All of the same capabilities could be easily merged into a half-dozen or so more-general, powerful functions, which would be easier both to use and to remember than is the current hodgepodge.

The C string functions illustrate the unfortunate consequences of design-by-committee. The original language and library definition has been cluttered almost beyond belief by people who couldn't resist the urge to add "just one more" feature. For example, does a high-level programming language really need a standard function (`strrev`) to reverse the characters in a string? It might be helpful to palindrome aficionados, but I have a hard time visualizing its use in typical C applications.

From the programmer's point of view, such a bewildering assortment of string functions is also a classic setup for the introduction of obscure bugs. Some of the functions' names differ only in one character, and the distinctions between their actions are sometimes equally subtle. All it takes is a little haziness of memory—or a too-quick glance at the runtime library reference manual—to drop a function that seems perfectly correct into a position where it can cause great damage.

For newcomers to the C language, the program TRYSTR.C (Figure 2) provides a simple test-bed for a variety of C string functions. It requests two strings and then processes them in several different ways. You can exit from the program at any time by entering Ctrl-C or Ctrl-Break. We'll be discussing these functions again in more detail in future columns.

■ The 80*x*86 family of processors provides a nice foundation for assembly language string handling.

STRING HANDLING IN MASM The Intel 80*x*86 family of processors provides a very nice foundation for assembly language string handling. In its repertoire of specialized string machine instructions are LODS (LOaD String), CMPS (CoMPare String), MOVS (MOVe String), SCAS (SCAn String), and STOS (STOre String). Each instruction's mnemonic can be suffixed with a B, W, or D to denote whether the instruction is to operate on bytes, words, or (in the case of the 80386) double-words.

All of these string instructions use the SI and/or DI registers for the addresses of their operands. Further, all increment or decrement these registers automatically, according to the state of the CPU's direction flag (controlled with the STD and CLD instructions). When they are combined with one of the "repeat" prefixes, they can very efficiently process series of bytes, words, or (in the case of the 80386) double-words. The repeat prefixes come in three flavors: REP (repeat while CX not zero), REPNZ (repeat while CX not zero and Z flag not set), and REPZ (repeat while CX not zero and Z flag not clear).

In assembly programming, common string operations can be (and usually are)

Runtime Library String Functions in Microsoft C 5.1

Function name	Terminated by null	Terminated by count	Terminated by character	Returns
String comparison functions				
memcmp	—	Yes	—	Flag
memicmp	—	Yes	—	Pointer
strcmp	Yes	—	—	Flag
strcmpi	Yes	—	—	Flag
stricmp	Yes	—	—	Flag
strncmp	Yes	Yes	—	Flag
strnicmp	Yes	Yes	—	Flag
String scanning and searching functions				
memchr	—	Yes	Yes	Pointer
strchr	Yes	—	Yes	Pointer
strcspn	Yes	—	Yes	Index
strlen	Yes	—	—	Length
strpbrk	Yes	—	Yes	Pointer
strrchr	—	Yes	Yes	Pointer
strspn	Yes	—	Yes	Index
strstr	Yes	—	—	Pointer
strtok	Yes	—	Yes	Pointer
String copying functions				
memccpy	—	Yes	Yes	Pointer
memcpy	—	Yes	—	Pointer
memmove	—	Yes	—	Pointer
movedata	—	Yes	—	Nothing
strcpy	Yes	—	—	Pointer
strncpy	Yes	Yes	—	Pointer
strdup	Yes	—	—	Pointer
String concatenating functions				
strcat	Yes	—	—	Pointer
strncat	Yes	Yes	—	Pointer
String initialization functions				
memset	—	Yes	—	Pointer
strnset	Yes	Yes	—	Pointer
strset	Yes	—	—	Pointer
String conversion functions				
strlwr	Yes	—	—	Pointer
strrev	Yes	—	—	Pointer
strupr	Yes	—	—	Pointer

Figure 1: *This listing by categories shows both the wide variety of string-handling functions in the C runtime library and how easy it may be to confuse one with another.*

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coded in-line, since the opcodes for the five string instructions listed above (even when combined with a repeat prefix) are shorter than a CALL instruction. For example, the following code copies a string of length bytes from string1 to string2 (similar to the C function `memmove`):

```
mov  si,seg string1
mov  ds,si
mov  si,offset string1
mov  di,seg string2
mov  es,di
mov  di,offset string2
mov  cx,length
cld
rep  movsb
```

The "B" appended to the MOVS mnemonic tells the assembler to generate the opcode for a byte move rather than a word or double-word move. On 8086, 80286, or 80386 machines, a string can be copied more quickly by using the word variety of the MOVS instruction, and then copying the odd byte with MOVSB if there is one:

```
mov  si,seg string1
mov  ds,si
mov  si,offset string1
mov  di,seg string2
mov  es,di
mov  di,offset string2
mov  cx,length
cld
shr  cx,1
rep  movsw
rcl  cx,1
rep  movsb
```

The following code compares the first length bytes of string1 with string2, setting the CPU flags appropriately (equivalent to the C function `memcmp`):

```
mov  si,seg string1
mov  ds,si
mov  si,offset string1
mov  di,seg string2
mov  es,di
mov  di,offset string2
mov  cx,length
cld
repz cmpsb
```

After the comparison, the CPU's Zero (Z) flag is set (1) if the strings were identical, and it is cleared (0) if the strings were different. In the latter case, the Sign (S) flag is set (1) if string1 was less than string2, or cleared (0) if string1 was greater than string2. Thus the CMPSB mnemonic is typically followed by a conditional jump instruction that tests the Z and S flags and takes the appropriate action. Note that the CLear Direction flag (CLD) instruction is included here for clarity, but the direction flag stays cleared (or set) until you change it; most applications just clear it once and leave it alone thereafter.

■ The 80*x*86 machines copy a string more quickly by using the word variety of the MOVS instruction.

Do you want to initialize an array? The code below stores length copies of char into memory starting at the address string1 (like the C function `memset`):

```
mov  di,seg string1
mov  es,di
mov  di,offset string1
mov  cx,length
mov  al,char
cld
rep  stosb
```

Do you need to search for the first occurrence of a character? The following code scans length bytes of string1 for char (like the C function `memchr`):

```
mov    di,seg string1
mov    es,di
mov    di,offset string1
mov    cx,length
mov    al,char
cld
repnz  scasb
```

After the scan, the Z flag is cleared (0) if there were no matching characters in string1. If a matching character was found, the Z flag is set (1) and ES:DI points 1 byte past the character.

Here's a cute trick that will come in handy when you are mixing assembly routines with C programs. The following code

```
/*
    TRYSTR.C    Try Out Some C Library String Functions
    Copyright (c) 1988, Ziff Communications Co.
    PC Magazine * Ray Duncan * October 31, 1988
*/

#include<stdio.h>
#include<string.h>

void main (void)
{

    char s1[80],s2[80];                 /* string buffers */

    int status;                         /* receives function
                                           result */

    while(1)
    {
        printf("\nEnter string 1 (s1): ");
        gets(s1);

        printf("\nEnter string 2 (s2): ");
        gets(s2);

        printf("\nLength of s1    = %d", strlen(s1));

        printf("\nLength of s2    = %d", strlen(s2));

        status = strcmp(s1, s2);    /* compare strings */
        printf("\nstrcmp(s1, s2)  = %d",status);

        status = strcmpi(s1, s2);   /* compare strings
                                       case insensitive */
        printf("\nstrcmpi(s1, s2) = %d",status);

        status = strcspn(s1, s2);   /* find first char in
                                       s1 contained in s2 */
        printf("\nstrcspn(s1, s2) = %d",status);

        status = strspn(s1, s2);    /* find first char in s1
                                       not contained in s2 */
        printf("\nstrspn(s1, s2)  = %d",status);

        (char *) status             /* find first occurence */
              = strstr(s1, s2);     /* of s1 in s2 */
        printf("\nstrstr(s1, s2)  = %s",status);

                                    /* lowercase the string */
        printf("\nstrlwr(s1)      = %s",strlwr(s1));

                                    /* uppercase the string */
        printf("\nstrupr(s1)      = %s\n",strupr(s1));
    }
}
```

Figure 2: *TRYSTR.C, a simple demonstration program for some common C string functions.*

finds the length of the ASCIIZ string1 (not including the terminal null byte) and leaves it in register CX:

```
mov    di,seg string1
mov    es,di
mov    di,offset string1
mov    cx,-1
xor    al,al
cld
repnz  scasb
not    cx
dec    cx
```

If you want to include the null byte in the length, just remove the DEC CX instruction. CX is used in an original way here. I can't take the credit for this clever snippet, and I have no idea who invented it; I picked it up along the way somewhere and have used it many times since.

■ The evolution of the C language shows us which types of functions have proved useful.

The examples given above have been rather simple. They don't check for overlapping regions during string moves, they don't allow for case insensitivity during string compares, and so forth. Although there's not much we can do about the baroque condition of the C runtime library, the evolution of the C language does show us which types of functions have proved useful over the years. We can use this information to advantage when designing a suite of string-handling routines for our Power Programming library.

In the next column, I'll present a set of general-purpose assembly subroutines to search, compare, concatenate, and extract strings that you can incorporate in your own programs.

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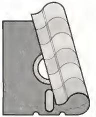


How to adjust SuperCalc's financial functions to analyze annuities due, create flashing screen messages in 1-2-3, and access upper-level ASCII characters in Quattro and 1-2-3.

An easy way to access ASCII box characters in *Quattro* and *1-2-3*

Creating "borders" in a *Lotus 1-2-3* worksheet using the -, _, and | characters has always frustrated me. Although the upper-level ASCII "box" characters would be better suited for this purpose, I was not able to access them in *1-2-3*, Release 2.0. Apparently, in this version *1-2-3* substitutes various international characters for these ASCII box characters.

Recently, I found that *Quattro* does not perform this same character substitution. I can access ASCII box characters by using the @CHAR function. For example, the function @CHAR(205) produces a double horizontal line, @CHAR(217) produces a lower-right single-line corner character, @CHAR(201) produces an upper-left double-line corner character, and so forth. In *1-2-3*, these same functions produce the characters I, U, and an accented E, respectively.

By embedding these @CHAR functions within @REPEAT functions, I can draw a variety of shapes in my *Quattro* worksheets. For example, the functions

```
A1:  @CHAR(201)&@REPEAT(@CHAR(205),36)&@CHAR(187)
A2:  @CHAR(186)&@REPEAT(" ",34)&@CHAR(186)
A3:  @CHAR(186)&@REPEAT(" ",34)&@CHAR(186)
A1;  @CHAR(201)&@REPEAT(@CHAR(205),36)&@CHAR(187)
```

produce a four-column by four-row double-line box in a *Quattro* worksheet. To reduce the amount of memory consumed, you can use the /Block Advanced Values command to replace these formulas with their results.—*Gerald L. Harrison; Pleasanton, California*

Unlike *1-2-3*, Release 2.0, *Quattro* uses the ASCII character set. By default, *1-2-3*, Release 2.01, uses the Lotus International Character Set (LICS)—the same character set that Release 2.0 always uses. However, you can command Release 2.01 to use the ASCII character set, just as *Quattro* does. Here's how.

First, exit from *1-2-3*, load the Install program, and select Advanced Options. From the Advanced Options menu, select Text Display. Then, from the Text Display menu, choose Universal Text Display-ASCII-No LICS. After you make this selection, return to Install's main menu, save the changes you've made, and exit from the Install program. Now, when you load *1-2-3* using the modified driver set, the @CHAR function will produce upper-level ASCII characters.

Both *Quattro* and *1-2-3* give you an alternative way to access upper-level characters: simply type the number of that character on the numeric keypad while holding down the Alt key. *Quattro* will display the ASCII character that corresponds to the number you typed. For example, if you type 201 while pressing the Alt key, *Quattro* will enter a double-line upper-left-corner character on the Edit line.

Unlike *Quattro*, *1-2-3* will enter only ASCII characters that are in the LICS—even if you have loaded *1-2-3* with a driver set that specifies the ASCII character set. If the ASCII character that corresponds to the code you type is not in the LICS, *1-2-3* will not enter anything on the Edit line. For example, a superscripted 2 is ASCII character 253 but LICS character 178. Since this character is in the LICS, *1-2-3* will produce a superscripted 2 when you press the Alt key and type 253. However, the Greek omega character (ASCII 234) is not in the LICS. Consequently, *1-2-3* will not produce a character when you hold down the Alt key and type 234.

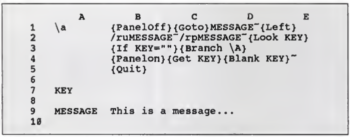
1-2-3 macros that make messages flash on the screen

In many of my macros, I need to present instructional messages on the screen. I used to use a {Goto} command to move the cell pointer to a cell that contained the message and a {Get} command to pause the macro. Then as soon as the user pressed any key, *Lotus 1-2-3* would continue executing the macro.

Recently, I modified this method so that the message flashes on and off. To do this, I set up a loop that unprotects and then reprotects the cell that contains the message. This causes the message to flash. The loop ends with a {Look} command, which checks to see if the user has pressed a key. If he has, *1-2-3* will break from the loop and continue executing the macro. If he has not, *1-2-3* will make another pass through the loop, flashing the message again.

Figure 1 shows an example of this macro routine. The first statement in this macro turns off the panel area of the screen and moves the cell pointer to the cell named MESSAGE (B9) and then to the cell to the left of that cell (A9). The first command in cell B2 unprotects the cell named MES-

■ SPREADSHEET CLINIC



```
         A            B            C           D          E
   1    \a         {Paneloff}{Goto}MESSAGE~{Left}
   2               /ruMESSAGE~/rpMESSAGE~{Look KEY}
   3               {If KEY=""}{Branch \A}
   4               {Panelon}{Get KEY}{Blank KEY}~
   5               {Quit}
   6
   7    KEY
   8
   9    MESSAGE    This is a message...
  10
```

Figure 1: *This macro routine presents a flashing message to the user.*

SAGE. On a color monitor, this command causes the label to change from white to yellow. On a monchrome monitor, it will make the label in MESSAGE brighter. The next command in this macro reprotects MESSAGE. On a color monitor, this changes the label in MESSAGE from yellow to white. On a monochrome system, it makes the label dimmer.

The final command in cell B2 tells *1-2-3* to see if a keystroke is stored in the keyboard buffer. If there is (as there will be if you have pressed a key since *1-2-3* started executing this routine), *1-2-3* will store the macro representation of that key in the cell named KEY (B7). If there is no keystroke in the keyboard buffer, *1-2-3* will enter a null label into KEY.

The {If} command at the beginning of cell B3 tests to see what KEY contains. If KEY contains a null label (as it will if you did *not* press a key), *1-2-3* will loop back to the cell named FLASH (B2). The commands in this cell flash the label in MESSAGE again, then test to see if you pressed a key. If KEY contains a label other than a null label (as it will if you *did* press a key), *1-2-3* will remove the key from the keyboard buffer, delete the representation of that key from the cell named KEY, and redraw the screen. At that point, *1-2-3* will continue executing the macro, beginning with whatever statements you have entered into cell B5.—*Ralph D. Sappe; Poughkeepsie, New York*

Unlike the {Get} command, the {Look} command checks the keyboard buffer without pausing the execution of the macro. If the keyboard buffer contains a keystroke, the {Look} command enters a representation of that key into the cell specified by its argument. However, it does not remove the keystroke from the buffer, as does the {Get} command. The {Get} command in cell B4 clears the keystroke from the buffer. Without this command, the keystroke would be passed on to *1-2-3* at the conclusion of the macro.

Calculating periodic payments and present or future values of annuities due in *SuperCalc*

In order to correctly calculate the present value or future value of a series of cash flows, or the periodic payments required to amortize a loan, you must know the timing of the cash flows. *SuperCalc4*'s financial functions (as well as those of many other software packages) are designed to analyze *immediate annuities*—investments whose cash flows occur at the end of each period. This assumption is appropriate for most financial calculations but not for all of them. Sometimes the cash flows occur at the beginning of each period. These investments are called *annuities due*.

Fortunately, it is relatively easy to adjust *SuperCalc*'s financial functions for up-front cash flows. To calculate the present value of an annuity due, you must reduce the term argument of the PV() function by 1, then add the amount of a single cash flow to the result of that function.

For example, suppose that cell B1 contains the periodic cash flow, cell B2 contains the periodic interest rate, and cell B3 contains the number of periods. If the cash flows will occur at the end of each period, you would use the function

`=PV(B1,B2,B3)`

to compute the present value, as we have in cell B5 of Figure 2. However, if the cash flows will occur at the beginning of each period, you would use the formula

`=PV(B1,B2,B3-1)+B1`

as we have in cell B7. Since each cash flow occurs sooner under the up-front assumption, the present value of the annuity due will be higher than that of the immediate annuity.

To calculate the future value of an annuity due, you must increase the term argument of the FV() function by 1, then subtract a single cash flow from the result of that function. For example, assume that cell B1 contains the periodic cash flow, cell B2 contains the periodic interest rate, and cell B3 contains the number of periods. If the cash flows will occur at the end of each period, you would have to use the function:

`=FV(B1,B2,B3)`

to calculate the future value, as shown in cell B5 of Figure 3. If the cash flows will occur at the beginning of each period, however, you would use the formula

`=FV(B1,B2,B3+1)-B1`

as shown in cell B7. Since each cash flow in the annuity due occurs earlier than each payment in the immediate annuity, the future value of the annuity due is greater than that of the immediate annuity.

To calculate the periodic payments on a loan for which the payments are due at the beginning of each period, you should divide the result of the ordinary PMT() function by the sum of 1 and the periodic interest rate. For example, suppose that cell B1 contains the principal amount, cell B2 contains the periodic interest rate, and cell B3 contains the number of periods. If the payments will occur at the end of each period, you would use the function

`=PMT(B1,B2,B3)`

to calculate the amount of each payment, as shown in cell B5 of Figure 4. If the payments will occur at the beginning of each period, however, you would instead use the formula

`=PMT(B1,B2,B3)/(1+B2)`

as shown in cell B7. When the loan pay-

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■ SPREADSHEET CLINIC

```
         A                                          B
1    Payment                                     $800
2    Rate                                 0.008333333
3    Term                                          36
4
5    Present Value (unadjusted)            $24,792.99
6    Present Value (adjusted)              $24,999.60
7
```

Figure 2: *The present value of an annuity due is greater than its immediate annuity equivalent.*

```
         A                                          B
1    Payment                                     $800
2    Rate                                 0.008333333
3    Term                                          36
4
5    Present Value (unadjusted)            $33,425.46
6    Present Value (adjusted)              $33,704.00
7
```

Figure 3: *The future value of an annuity due is greater than its immediate annuity equivalent.*

```
         A                                          B
1     Principal                               $25,000
2     Rate                                   0.008333
3     Term                                         36
4
5     Periodic Payment (unadjusted)           $806.68
6     Periodic Payment (unadjusted)           $800.01
7
```

Figure 4: *The periodic payments for an annuity due will be less than those for an equivalent immediate annuity.*

ments are made at the beginning of each period, the total amount of interest paid over the term of the loan will be less. Consequently, the amount of each loan payment will be less than if the payments occurred at the end of each period.—*Alan Foote; Westlake, Ohio*

These adjustments of *SuperCalc*'s financial functions are correct. *1-2-3*, *Symphony*, and *Plan Perfect* also assume that cash flows occur at the end of each period rather than at the beginning. To calculate present values, future values, and periodic payments of annuities due in *1-2-3* or *Symphony*, you would use the formulas

```
@PV(payment,rate,term-1)+paymant
@FV(payment,rate,term+1)-payment
@PMT(principal,rate,term)/(1+rate)
```

To make these calculations in *Plan Perfect*, you would use the formulas

```
=PV(rata,payment,tarm-1,0)+payment
=FV(rata,payment,term+1,0)-payment
=PMT(rata,principal, term,0)/(1+rate)
```

Excel's PV(), FV(), and PMT() functions have arguments that let you specify the timing of periodic cash flows. Consequently, no external adjustment is necessary if you use this spreadsheet.

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USER-TO-USER

Enhancing PC-DOS DISKCOPY to create multiple disk copies; loading batch files and utilities faster using a RAMdisk; avoiding a bug in DOS 3.1 BACKUP.

The DOS 3.1 BACKUP program is trouble for large read-only files

A couple of months ago I used BACKUP (the DOS 3.1 version) to back up my entire 20MB hard drive in order to reformat it. After I restored these files onto my newly formatted hard disk, I found out that the files residing on more than one diskette had been only partially copied.

The reason? I've protected all my files with the read-only attribute. When RESTORE copied a file back to my hard disk, it copied the first portion of the file, added the read-only attribute, and asked for the next diskette. When it got to appending the other part of the file, it couldn't do so because of the read-only attribute, so it skipped it and went ahead to the next file.

I lost over 50 files this way! I was outraged at the folly of Microsoft and IBM, manufacturers of MS-DOS and PC-DOS. The RESTORE program never even tried to warn me that something was wrong. I use PC-DOS 3.1, so I don't know if the bug has been fixed yet. If it hasn't, a lot of users are in for trouble.*—Amir Hermelin; Kyriat Yam, Israel*

BACKUP can split your files across more than one floppy disk. Normally, RESTORE simply copies the first portion of a split file and then appends the remaining portion(s) to it. Apparently, the DOS 3.1 version of BACKUP gives the first portion the read-only attribute, preventing the addition of the other portions.

Fortunately, this problem doesn't occur in DOS 3.0, 3.2, or 3.3, but a lot of you are 3.1 users. If you do use 3.1 and you use the read-only attribute, you'd be smart to remove it before backing up. The command

```
ATTRIB -R C:\*.* /S
```

will remove the read-only attribute from all files on drive C:. You can create a batch file to make certain files read-only again after you RESTORE.

A batch file technique that allows conditional branching

Occasionally I need to start DOS without loading the collection of TSRs in my AUTOEXEC.BAT file. One way to do this is to rename the AUTOEXEC file before booting the system. To save time and keystrokes, I wrote a 10-byte program called SHFTPICK.COM, which sets ERRORLEVEL according to the state of the Shift, Ctrl, and Alt keys. Then I added these lines to AUTOEXEC.BAT:

```
SHFTPICK
IF ERRORLEVEL 8 GOTO EXIT
...
...
:EXIT
```

If Alt is down when the system calls AUTOEXEC.BAT, SHFTPICK sets ERRORLEVEL to 8, and the next statement bypasses the rest of the procedure. Don't press Alt until DOS starts to load; any keys held down during the ROM self-test generate a keyboard error message.

SHFTPICK returns 4 if Ctrl is down, and 2 and 1 for the Left and Right Shift keys, respectively. Multiple key values are added. If you take out the AND statement in the fourth line, it will also indicate the toggle key states: Insert (128), CapsLock (64), NumLock (32), and ScrollLock (16).*—Dick Peterson; Davenport, Iowa*

To make SHFTPICK.COM, create the DEBUG script SHFTPICK.SCR by typing the instructions shown in Figure 1 exactly as shown, including the blank lines after INT 21 and after the final Q. Make sure DEBUG is available, either in the current directory or on your path, then enter this command:

```
DEBUG < SHFTPICK.SCR
```

This creates SHFTPICK.COM for you. The handy thing about SHFTPICK is that you don't have to press any key. If you leave the system alone, it uses whatever default you've defined in your batch file.

```
A 100
MOV AH,02
INT 16
AND AL,0F
MOV AH,4C
INT 21

RCX
A
N SHFTPICK.COM
W
Q
```

Figure 1: *This DEBUG script creates SHFTPICK.COM, which lets you control the execution of batch files.*

Remember that the command IF ERRORLEVEL n, where n is a number, really means IF ERRORLEVEL >= n. In the previous example, any combination of Shift keys that includes Alt will trigger the GOTO, because any such combination will return an ERRORLEVEL >= 8. Replacing that line with

```
IF ERRORLEVEL 8 IF NOT ERRORLEVEL 9 GOTO Exit
```

will make a batch file that branches *only* when Alt alone is pressed.

A simple patch to DISKCOPY creates multiple disk copies without rereading the original

The DEBUG script file MULTCOPY.SCR, shown in Figure 2, will create MULTCOPY.COM from the IBM PC-DOS 3.3 DISKCOPY.COM program. MULTCOPY does the same thing as DISKCOPY with the enhancement of being able to create multiple copies from a single reading of the source disk. Of course, there must be sufficient free memory to hold MULTCOPY itself and the contents of the disk, which limits it to 360K disks. PC user groups will find it helpful in reproducing their disks of the month.

Type in MULTCOPY.SCR as a pure-ASCII file. Be sure to leave a blank line after the final RET and to press the Enter key at the end of each line, including after the Q in the last line. Then with a copy of PC-DOS 3.3 DISKCOPY.COM in the current directory and DEBUG.COM handy (in the current directory or in a directory on the path), enter the following command at the DOS prompt:

```
DEBUG DISKCOPY.COM < MULTCOPY.SCR
```

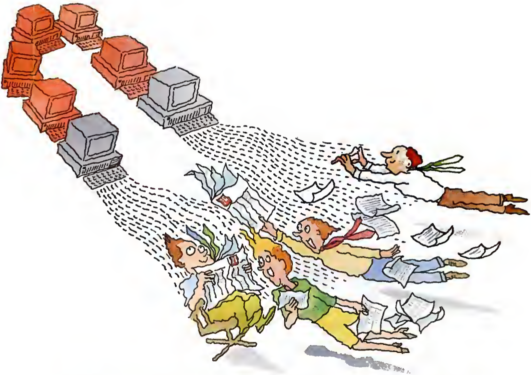
This will create the new file named MULTCOPY.COM.

This patch will work only with PC-DOS 3.3 DISKCOPY. Mine is dated 3-17-87 and is 6295 bytes. The code I am changing begins and ends with the instructions shown in Figure 3. The xxxx represents the segment that will vary.—*Bob Stephan; Pebble Beach, California*

If you're making multiple copies of the same disk, it makes a lot of sense to read that disk into RAM just once. Repeat copies will take a little over half the time of the first copy. MULTCOPY lets you do that, as long as you have 368K RAM free. I added a bit of code to the original MULT-

```
N MULTCOPY.COM
A 708
MOV  DX,0F04
PUSH DX
PUSH CS
CALL 13E2
CALL 139A
MOV  DX,0F38
PUSH DX
PUSH CS
CALL 13E2
MOV  AL,[0369]
AND  AL,DF
CMP  AL,[0EE0]
JZ   0730
CMP  AL,[0EE1]
JNZ  0708
STC
JMP  0741
NOP
MOV  BYTE PTR [030A],01
MOV  BYTE PTR [035D],00
CALL 07A0
CLC
JMP  0708
NOP
RET

A 100
JMP 1997

A 1997
PUSH AX
PUSH BX
MOV BX,CS
MOV AX,[2]
SUB AX,BX
CMP AX,5C00
JB 19A8
POP AX
POP BX
JMP 0601
RET

RCX
18AB

E118E 07
W
Q
```

Figure 2: *The DEBUG script that contains instructions to turn DISKCOPY.COM, Version 3.3, into MULTCOPY.COM.*



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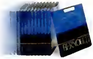

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■ USER-TO-USER

COPY.SCR that checks for enough RAM; if there isn't enough, it just quits. I also replaced the space between "... another diskette?" and "(Y/N)" with a BEEP character. Now when MULTCOPY wants another diskette, it will beep the speaker to get your attention.

If you're not sure you have the right version of DISKCOPY.COM, load it into DEBUG with the command

```
DEBUG DISKCOPY.COM
```

Then give the command

```
U 708 712
```

The resulting display should look like the first half of Figure 3, with the xxxx's replaced by a hex number. Now enter the command

```
U 736 741
```

and compare the result with the second half of Figure 3. If both displays match, you've got the right version. Enter Q to quit DEBUG and then start it up again with the script as input.

Single floppy disk drive users will love MULTCOPY, since it lets them make copies without repeatedly swapping disks. But note that if you try to use this patched DISKCOPY for anything but 360K standard diskettes, it will make bad copies and will not warn you that it's doing so.

```
xxxx:0708 BA380F        MOV  DX,0F38
xxxx:070B 52            PUSH DX
xxxx:070C 0E            PUSH CS
xxxx:070D E8D20C        CALL 13E2
xxxx:0710 BA040F        MOV  DX,0F04

. . .

xxxx:0736 3A06E10E      CMP  AL,[0EE1]
xxxx:073A 75CC          JNZ  0708
xxxx:073C F9            STC
xxxx:073D EB02          JMP  0741
xxxx:073F 90            NOP
xxxx:0740 F8            CLC
xxxx:0741 C3            RET
```

Figure 3: *A portion of a DEBUG listing showing the area patched by MULTCOPY.SCR.*

Speed up batch files and utilities by running them from a RAMdisk

While reading your article on RAMdisks from the May 17, 1988, issue ("Analyzing Your RAMdisk Needs," Utilities), I thought, what if I moved my utilities and batch files to the RAMdisk—even most of AUTOEXEC.BAT?

I moved my most useful utilities into the C:\BAT subdirectory and modified my AUTOEXEC.BAT file as follows:

```
E:
MD BAT
CD\BAT
PATH=E:\BAT;C:\DOS;C:\WINDOWS
PROMPT $P$G
COPY C:\BAT /V
CONTAUTO
```

Now AUTOEXEC switches to RAMdrive E:, creates the E:\BAT directory, sets the PATH to include E:\BAT, and copies my utilities and batch files to that directory. Once the files have been copied, AUTOEXEC calls CONTAUTO .BAT (CONTinue AUTOexec), which runs from the RAMdisk, and all the utilities it calls are also on the RAMdisk. The utilities load faster and they do it without the annoying ka-chunk of the hard drive!

Next I tried running the PCMAG utility SWEEP DDIR from the root directory of the C: drive. Wow! When both SWEEP and DDIR are run from the RAMdrive, they cut down hard disk access to the point where all you hear is a slight chirp as DDIR reads a directory.

Since these batch files and utilities are tiny, I use a small 64K RAMdisk. I found this technique works very well for speeding up slower 4.77-MHz machines.—*Bill Cooper; Granville, Ohio*

I've used exactly this technique for quite some time. On one system, I have over 50 lines of batch commands to execute at boot time, and running most of them from the RAMdisk is incredibly faster.

SWEEP DDIR is special because SWEEP executes DDIR in every subdirectory it finds. It has to load DDIR each time, and if you have many subdirectories, that's a lot of loading.

Neil J. Rubenking is a contributing editor of PC Magazine.

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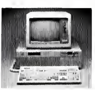

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You might even end up committing suicide.

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Cocaine can alter brain chemistry until you prefer it over everything—food, water, even sex. It could also make you do things you wouldn't normally do.

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However, nearly 700 people died of cocaine abuse last year. 2-3 million are addicts. And all these victims have one thing in common. They didn't think anything would happen to them, either.

Grow up.

With cocaine, you never know whether you'll get hooked or not. Or whether you'll die or not. And no one in the world can tell you. No doctor. No expert.

But when you face that first line, you may be hearing a lot of other things. Like coke's a fantastic trip. Or that everybody who's somebody does it. You might even hear that it'll make you a man.

But now you know what cocaine can do to you.

And if you really want to prove you're a man, you'll make your own decisions.

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■ EDITED BY CRAIG L. STARK

POWER USER

Printing labels on a LaserJet; simulating a window in WordStar; recovering memory from Clipper; entering high-order ASCII characters in WordStar.

A point-and-shoot approach to entering high-order characters in most word processing programs

WordStar's newfound ability to use high-order characters is welcome, but having to hold down Alt while typing the ASCII codes on the numeric keypad is still too much work. Here's a shortcut that, with appropriate modifications, works on any word processor that uses the same strategy for producing high-order characters.

Start by creating a chart of the high-order characters. You can do this within *WordStar*. Use the Alt key and the numeric keypad to type the characters, in order, starting with Alt-128. After creating all the characters from 128 to 255 (80h to FFh), arrange them as shown in the upper portion of Figure 1.

Save the chart as a file, WSCHAR. Then, the next time you need to include high-order characters in a file, import WSCHAR with the Read command, Ctrl-KR (^KR in conventional notation, used hereafter). To include a character from the chart, position the cursor on the character, type ^KB, move the cursor right one character and type ^KK, then move the cursor to where the character should go and type ^KC. Note that each line in the chart begins with a "double dot" comment command, so you can leave the chart in the file and *WordStar* will not print it.*—Dan Lasley; Cordova, Tennessee*

This shortcut doesn't go far enough. It eliminates the effort of looking up the ASCII codes, but once you've found the right character, the "shortcut" adds more keystrokes than it saves.

One easy solution is to set up the chart for decimal rather than hexadecimal ASCII codes, as shown in the lower portion of Figure 1. This gives you the decimal code for the character, which you can enter with either the Alt key and numeric keypad or the mark-and-copy approach that was suggested.

The mark-and-copy approach is more appealing if you automate it. With *WordStar*, you might want to create the following macro:

```
^KB^D^KK^Q1^KC
```

This technique *almost* allows you to point and shoot. When you want to insert a high-order character, you simply mark the position with ^K1, position the cursor on the character that you would like copied, and then invoke the macro. Everything else is automatic. If you use an external macro

```
             0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
----------------------------------------------------------------
.. 80        Ç  ü  é  â  ä  à  å  ç  ê  ë  è  ï  î  ì  Ä  Å
.. 90        É  æ  Æ  ô  ö  ò  û  ù  ÿ  Ö  Ü  ¢  £  ¥  ₧  ƒ
.. a0        á  í  ó  ú  ñ  Ñ  ª  º  ¿  ⌐  ¬  ½  ¼  ¡  «  »
.. b0        ░  ▒  ▓  │  ┤  ╡  ╢  ╖  ╕  ╣  ║  ╗  ╝  ╜  ╛  ┐
.. c0        └  ┴  ┬  ├  ─  ┼  ╞  ╟  ╚  ╔  ╩  ╦  ╠  ═  ╬  ╧
.. d0        ╨  ╤  ╥  ╙  ╘  ╒  ╓  ╫  ╪  ┘  ┌  █  ▄  ▌  ▐  ▀
.. e0        α  β  Γ  π  Σ  σ  µ  τ  Φ  θ  Ω  δ  ∞  φ  ∈  ∩
.. f0        ≡  ±  ≥  ≤  ⌠  ⌡  ÷  ≈  °  ∙  ·  √  ⁿ  ²  ■


             0  1  2  3  4  5  6  7  8  9
----------------------------------------------------------------
.. 120                               Ç  ü
.. 130       é  â  ä  à  å  ç  ê  ë  è  ï
.. 140       î  ì  Ä  Å  É  æ  Æ  ô  ö  ò
.. 150       û  ù  ÿ  Ö  Ü  ¢  £  ¥  ₧  ƒ
.. 160       á  í  ó  ú  ñ  Ñ  ª  º  ¿  ⌐
.. 170       ¬  ½  ¼  ¡  «  »  ░  ▒  ▓  │
.. 180       ┤  ╡  ╢  ╖  ╕  ╣  ║  ╗  ╝  ╜
.. 190       ╛  ┐  └  ┴  ┬  ├  ─  ┼  ╞  ╟
.. 200       ╚  ╔  ╩  ╦  ╠  ═  ╬  ╧  ╨  ╤
.. 210       ╥  ╙  ╘  ╒  ╓  ╫  ╪  ┘  ┌  █
.. 220       ▄  ▌  ▐  ▀  α  β  Γ  π  Σ  σ
.. 230       µ  τ  Φ  θ  Ω  δ  ∞  φ  ∈  ∩
.. 240       ≡  ±  ≥  ≤  ⌠  ⌡  ÷  ≈  °  ∙
.. 250       ·  √  ⁿ  ²  ■
```

Figure 1: *The high-order IBM character set in hex (top) and in decimal (bottom).*

program such as *SuperKey*, you can include the ^K1 command in the macro, add a variable field to allow you to position the cursor on the character, and automate the procedure even further.—*M. David Stone*

Viewing a second text file in *WordStar* without closing the first

When working on one document it's often useful to be able to view another, either to import text from the second document or simply to check something. Unfortunately, *WordStar* doesn't do windows, but the Esc-W macro below will serve as a poor man's window:

```
^KB   ^KK^S^S^KR
```

Note that there are three spaces between the ^KB (Ctrl-KB) and the ^KK. The macro creates a marked block of three spaces, backs the cursor up to the middle of the block, and gives the Read File command. You then enter the second filename, and the file is read into the block. After reading the file, you can "close the window"—actually delete the file—with ^KY.—*Rev. Terry Carnes; Teslin, Yukon, Canada*

After reading in the file, if you then mark a block of text to copy from the second document to the first, you will lose the beginning and end markers that define the "window." The cure is to change the macro to

```
^KB^K1   ^K2^KK^S^S^KR
```

Then create a second macro, Esc-C, for Close:

```
^Q1^KB^Q2^KK^KY^KH
```

Now the Window macro will leave place markers at the beginning and end of the imported file. If you move the beginning and end markers, you can use Esc-C to automatically re-mark the "window" and delete it. The final ^KH hides the place markers K1 and K2.—*M. David Stone*

Making your printer ask for a sheet of paper in *WordPerfect*

In the February 16, 1988, issue, you warned readers about the situation in which *WordPerfect* might beep the computer to request a new sheet of paper when the printer was not actually ready for it. If your printer has its own beeper, you can use the PRINTER program on the *WordPerfect* Printers disk to make your *printer* beep when it's ready for a new sheet. Edit the Printer Initialization for your printer to make *WP* send a bell code to the printer when waiting for a "Go". The printer will not beep until it reaches the bell code in its buffer, at which time it is actually ready for the next sheet.—*Allen T. Fincher; Suffolk, Virginia*

WordPerfect beeps the computer when the printer has accepted one pageful of characters. However, this doesn't mean it has *printed* that page—much of the text may still be in the printer's buffer. Mr. Fincher's tip makes it easy to hear when the printer itself is ready for another page. The exact steps in the PRINTER program are the following:

- Select #3, "Printer Definitions (Examine, Change)".
- Select the printer you want to change.
- Select #1, "Printer Initialization".
- Select #7, "Send Bell (ASCII 7) to Printer When Waiting for a 'Go'?".
- Press "Y" for Yes.
- Hit Enter four times to exit the program.—*Neil J. Rubenking*

A simple *dBASE III* program that will make printing labels on a LaserJet easy

The program shown in Figure 2 is useful for printing labels from *dBASE III* on the HP LaserJet printer. The setup below is for Avery #5261 sheets, each of which holds 20 1- by 4-inch labels (two columns of 10). The settings for the .LBL label format files are as follows:

```
Predefined size:        3 1/2 x 15/16 by 2
Label width:            39
Label height:           5
Left margin:            1 (0 for Series II)
Lines between labels:   1
Spaces between labels:  3
Labels across page:     2
```

I've also found that it helps to fan the label sheets before putting them into the paper tray.—*Mark Coppola; Greenvale, New York*

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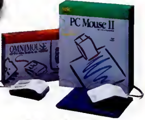

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```
SET DEVICE TO PRINT
@ 0,0 SAY CHR(27)+[E]         && reset printer
@ 0,0 SAY CHR(27)+[&13E]      && set top margin to 3
                              && use top margin 2 for Series II
@ 0,0 SAY CHR(27)+[&160F]     && set text length to 60
SET DEVICE TO SCREEN
LABEL FORM <filename> TO PRINT
EJECT                         && eject last page
SET DEVICE TO PRINT
@ 0,0 SAY CHR(27)+[E]         && reset printer
SET DEVICE TO SCREEN
RETURN
```

Figure 2: *A* dBASE *program for printing labels on HP LaserJet printers.*

Compared with a dot matrix printer, the HP LaserJet and compatibles require extra setup procedures, but the quality and speed increases are substantial.

The LaserJet manual cautions against label sheets that have cutout gutters between the label columns. The reason, according to one HP customer service representative, is that label sheets with cutouts anywhere except along the outer ½-inch border are far more prone to lift off the sheet. If this has ever happened to you on a dot matrix printer, you can imagine how a separated label will gum things up in the laser's hot fusing area.

You can reduce this danger even further by opening the back of your printer to shorten and straighten the paper path.
—Brad Stark

Saving some of the memory required by *Clipper*'s new release

Prospective users of *Clipper*'s new(!) Summer '87 release should be aware that the program now requires substantially more memory than the company leads you to believe.

The old (Autumn '86) manual states that the total memory required to run an application is 64K more than the size of the "load module" (which is basically the size of the .EXE file). The Summer '87 manual says to allow 64K to 100K more. In practice, however, I've found the main program has a load module size of 260K but requires 450K to run—without using the "SET CLIPPER" settings. That's a full 190K more than the load module size.

If you're bumping up against your machine's free memory limit, I have found that you can reduce the load module size by 20K simply by removing two references to the MOD() function.*—Wayne Thomas; Hanson, Massachusetts*

Clipper is not alone in having ballooned in size to keep up with users' demands for more power and speed. Only 5 years ago, I could put *dBASE II*, *VisiCalc*, and *WordStar* on a single 160K floppy; including ancillary programs, this summer's *dBASE IV* would require *30* such floppies.

A Nantucket support staffer explained that MOD() belongs to a "special function group," which is listed below.

AMPM
BROWSE
DAYS
DBF
FKLABEL
FKMAX
LENNUM
MOD
OS
READKEY
SECS
STATLINE
STRZERO
TSTRING
VERS
XBROWSE

If *any* of these functions are used in an application, a special section of the Extend Library is opened, at the cost of the 20K of memory Mr. Thomas is currently saving.*—Brad Stark*

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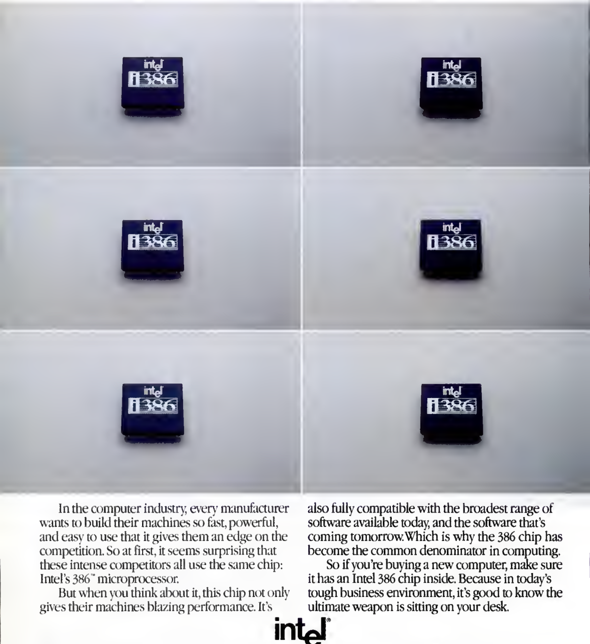
intel
i386

■ **EDITED BY ROBERT L. HUMMEL**

LANGUAGES

Hiding copyright notices in BASIC; creating comma-delimited numbers in FORTRAN; handling real numbers in Turbo Pascal; solving QuickBASIC's object file format problems.

Two fast and efficient routines to round floating-point numbers in BASIC

The rounding solution that was presented in Languages (November 10, 1987) may be more efficient than some other methods programmers use to solve this problem, but I would like to offer a simpler approach. The function that is shown in Figure 1 is contained entirely in a single line and is approximately two and a half times as fast as the one previously submitted. Because it does not depend on any tricks or devious string manipulation, its accuracy is immediately apparent by direct inspection.*—Anthony W. Severdia; San Francisco, California*

I have seen many BASIC rounding routines, most of which could only be described as horrid. The function shown in Figure 2 is not only shorter and faster but allows rounding to the nearest *fraction*. *—Grant Lawrence; Portland, Oregon*

```
Def FnRound(Value, Places) = _
    Sgn(Value) * Int(10^ Places * Abs(Value) + .5) / 10^ Places
```

Figure 1: *A BASIC function that rounds a value to any number of decimal places.*

```
Def FnRound(Amount, Template) = _
    Sgn(Amount) * Int(.5 + Abs(Amount) / Template) * Template

'where Template = .01 for 2 decimal places, .05 to round to the
'  nearest nickel, or .25 for the nearest quarter.
```

Figure 2: *A BASIC function that can round to any nearest fraction.*

Judging by the amount of mail we received, it is obvious that rounding is an important subject to a lot of BASIC programmers. Both of these routines are indeed more efficient than the one printed earlier, but I particularly like Mr. Lawrence's solution because it is not limited to a given number of places only. For example, you could round 102 to the nearest 5, to obtain a result of 100.

Notice that both of these functions should really be written using double-precision variables for the amount. This will ensure as high a degree of accuracy as possible when dealing with very large or small numbers, or when specifying many decimal places. Also, to convert from the number of places to the "template" variable required by the function in Figure 2, use the formula

```
Template = 10^ -Places
```

—Ethan Winer

A quirk in the Read function of Turbo Pascal

The program in Figure 3 shows a marked difference between Turbo Pascal Versions 3.0 and 4.0. In the former, a series of separate Read statements could read a series of variables. But the result looked odd (see Figure 4). Nothing happened when you hit Enter, and the variables ended up all

```
PROGRAM Reading;
(*Run this under TP3 and TP4 to see the difference*)
VAR
  SArray : array[1..5] of String[255];
  Count  : byte;
BEGIN
  FOR Count := 1 to 5 DO Read(SArray[Count]);
  WriteLn;
  WriteLn('You entered the following:');
  FOR Count := 1 to 5 DO WriteLn(Count,') ',SArray[count]);
END.
```

Figure 3: *The Read procedure has changed in Turbo Pascal 4.0. Run this program in both versions of Turbo Pascal for a demonstration.*

■ LANGUAGES

```
dogcatpigrathog
You entered the following:
1) dog
2) cat
3) pig
4) rat
5) hog
```

Figure 4: *The output of the Reading program under Turbo Pascal 3.0.*

```
dog

You entered the following:
1) dog
2)
3)
4)
5)
```

Figure 5: *The output of the Reading program under Turbo Pascal 4.0.*

mashed together on the screen. Run it under Version 3.0 to see the result.

This behavior for Read is not standard Pascal, and Version 4.0 has become more standard. In this version, a Read statement doesn't clear the final Enter from the input buffer. Hence, any succeeding Read statements before a ReadLn immediately return a null string without further input (see Figure 5). Run the program under Version 4.0 to see the new behavior.

If your programs rely on Read's nonstandard behavior, you'll have to change them to work with Version 4.0. The Upgrade program that comes with it can't detect this particular problem, so you'll have to do it.—*Neil J. Rubenking*

A straightforward function to generate comma-delimited numbers in FORTRAN

Without question, commas improve the readability of figures—especially if the figures are several digits long. But FORTRAN doesn't contain any direct method for printing data with commas. I have developed and used the following function subroutine (COMA) to print any REAL value with the necessary commas inserted. COMA is a flexible function routine that operates very fast.

```
C-----------------------------------------------------------------------
C  A FORTRAN function to display comma-delimited numbers.
C-----------------------------------------------------------------------
      PROGRAM TESCOMS

      REAL*8  R
      CHARACTER*13 COMA, RCOMMA

      R = 1234567.75
      RCOMMA = COMA(R)
      WRITE (*, 10000)  RCOMMA

      R = 1234.56
      RCOMMA = COMA(R)
      WRITE (*, 10000)  RCOMMA

10000 FORMAT (5X, A13)
      STOP
      END

C-----------------------------------------------------------------------
C  Return the formatted number as a right-justified string.
C-----------------------------------------------------------------------
      CHARACTER*13 FUNCTION COMA(R)
      REAL*8  R, RABS

      RABS = DABS(R)
      JRABS = RABS

      IF (RABS .GE. 1000.)  GO TO 10

      WRITE(COMA, '(F13.2)')  R
      RETURN

00010 CONTINUE      IF (RABS .GE. 1000000.)  GO TO 20
      LR = R / 1000
      RR = DMOD (RABS,DBLE(1.))
      MR1 = MOD(JRABS/100, 10)
      MR2 = MOD(JRABS/10, 10)
      MR3 = MOD(JRABS, 10)
      WRITE (COMA, '(I6, 1H,, 3I1, F3.2)')  LR, MR1, MR2, MR3, RR
      RETURN

00020 CONTINUE
      LR = R / 1000000
      RR = DMOD (RABS, DBLE(1.))
      MR1 = MOD(JRABS / 100000, 10)
      MR2 = MOD(JRABS / 10000, 10)
      MR3 = MOD(JRABS / 1000, 10)
      MR4 = MOD(JRABS / 100, 10)
      MR5 = MOD(JRABS / 10, 10)
      MR6 = MOD(JRABS, 10)
      WRITE (COMA, '(I2, 1H,, 3I1, 1H,, 3I1, F3.2)' )
     &  LR, MR1, MR2, MR3, MR4, MR5, MR6, RR
      RETURN
      END
```

Figure 6: *The program listing far TESCOMS.FOR, a flexible FORTRAN function that prints any REAL value with the necessary commas inserted.*

Use of this function is fast, easy, and straightforward. An example program that prints a REAL*8 variable (to the screen) is shown in Figure 6, and the output it produces is shown in Figure 7. A corresponding subroutine for printing integer variables would require only a small modification of the one shown here.—*Eldon R. Linn; Falls Church, Virginia*

```
     1,234,567.75
         1,234.56
Stop - Program terminated.
```

Figure 7: *The output far the program listing shown in Figure 6.*

Anyone generating financial reports (as well as those reading them) will certainly appreciate this easy-to-use function. It automatically produces right-justified output so that numbers printed in columns will line up correctly.

Sometimes the number printed will have a different value than you'd expect, especially when it's very large. This is due to the round-off error caused by the limited precision of a REAL variable.—*Robert L. Hummel*

```
{$R-,S+,I+,D+,T-,F-,V+,B+,N-,L+ }
{$M 16384,0,655360 }
PROGRAM NewValDemo;
VAR
  L : String;
  R : Real;
  C : Integer;

  PROCEDURE Val(S : string; VAR result : real; VAR code : integer);
  BEGIN
    WHILE (length(S) > 0) AND (S[1] = ' ') DO
      Delete(S,1,1);
    IF pos(' ',S) > 0 THEN
      Delete(S,Pos(' ',S),255);
    IF S[1] = '.' THEN S := '0' + S;
    IF S[length(S)] = '.' THEN S := S + '0';
    System.Val(S,result,code);
  END;

BEGIN
  Write('Enter a real number:');
  ReadLn(L);
  Val(L,R,C);
  IF C > 0 THEN WriteLn('ERROR at character #',C)
  ELSE WriteLn('You entered ',R:1:11);
END.
```

Figure 8: *A more flexible Val procedure for handling real numbers in Turbo Pascal.*

A flexible program in Pascal that handles real numbers

Turbo Pascal, Version 4.0, is stricter than Version 3.0 regarding numeric formats. Real numbers can't begin or end with a decimal point now—in Version 3.0 you could use ".1" or "65536"; Version 4.0 wants "0.1" and "65536.0".

In many cases, you can make the change yourself—if you have real number constants in your programs, fix them to conform with the new format. If your input is coming from another system or interactively from the user, you have a problem. You could read the input as a string, then parse it and convert the individual substrings to real numbers using the Val procedure. But Val also requires at least one digit on each side of the decimal point.

Figure 8 demonstrates a new Val procedure that handles numeric strings less strictly. It cleans up input by removing any leading spaces and truncating it at the first internal space it finds. When it's done fixing the string, it calls the regular Val procedure. It gets access to that procedure by referring to the UNIT—note the call to System.Val. Any time you have same-named procedures in different UNITs, you can distinguish them in this way.

The new Val procedure is more limited than the original—it works only for real numbers. I gave it the same name as the old in order to demonstrate calling using the UNIT name, but in practice you'll probably want to name the new one "ValR" or something that makes this limitation clear.—*Neil J. Rubenking*

Using BASIC to hide copyright notices

Most programmers write copyright notices as text strings within the program. The problem with this method is that anyone with a copy of *The Norton Utilities* or some other disk editor can modify or remove the message entirely. One solution is to embed the characters as DATA statements and assign them to a string when the program runs. This makes the text impossible to locate using conventional methods, while still protecting and preserving the copyright (see Figure 9).—*Robert Greenhouse; Palo Alto, California*

The flaw in this method is that more space will be needed to store the message, since BASIC keeps numbers in DATA statements as the ASCII values for each digit. This won't be much of a liability, especially when the added security is important. But one place DATA statements won't help is where a serial number is to be embedded in the code. A better solution would be to store the number as a floating-point value rather than as a string.

```
S# = 123456
PRINT "Serial Number"; S#
```

—Ethan Winer

```
'----- ineffective method
C$ = "Copyright (c) 1988 XYZ Corp"
PRINT C$

'----- better method
FOR X = 1 TO 27
    READ V
    C$ = C$ + CHR$(V)
NEXT
PRINT C$
DATA 67, 111, 112, 121, 114, 105, 103, 104, 116, 32, 40, 99, 41
DATA 32, 49, 57, 56, 56, 32, 88, 89, 90, 32, 67, 111, 114, 112
```

Figure 9: *A simple but effective way to hide copyright notices.*

Overcoming problems with QuickBASIC's object file formats

In QuickBASIC, Versions 2.0 and 3.0, not all compiled .OBJ files are alike. If you've written a subprogram and intend to compile it for inclusion in a user library, Microsoft's documentation states that the subprogram must be compiled as a BRUN.LIB file. If you're working outside of the editing environment, then you would omit the /O option:

```
QB QBSUB;
```

This will create an object file named QBSUB.OBJ that can be included in a user library. But if you later decide to link this file to a main module that was compiled with the BCOM.LIB (/O) option, the resulting program will crash without any in-

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dication as to what went wrong.

To correct this, the original subprogram must be *recompiled*, using the BCOM .LIB (/O) option. Because of a primary difference in the two compilation methods, programs that were compiled to use BRUN.LIB cannot be linked to other programs that were compiled for BCOM .LIB.*—Richard G. Minutillo; Roslindale, Massachusetts*

This is a particularly insidious problem because most programmers prefer to create a final program that does not require QuickBASIC's runtime support library. Unless a program is very large or is composed of a number of modules that must share common data, it generally makes more sense to use the BCOM.LIB (/O) compile option. But as you observed, this doesn't work for programs that will be added to a user library.

This problem has been partially remedied in QuickBASIC 4.0 because that version can create Quick Libraries directly from within the editing environment. Nonetheless, many programmers continue to use their own editor and compile their programs directly from the DOS command line. In those cases, it is important to understand the distinction between the two types of .OBJ files.

Also, readers who are still using QuickBASIC 3.0 should be aware of another, equally insidious bug. Many programs that are compiled to a BCOM.LIB file from inside the environment simply will not work. The program will appear to compile and link correctly, but when it is run the computer will simply lock up and die. The solution is to compile outside of the editor, using /O along with any other options that are needed.*—Ethan Winer*

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PC TUTOR

Determining the amount of available space on your hard disk; exchanging the functions of the CapsLock and Ctrl keys by monitoring keystrokes with CTRLCAP.COM.

An advanced BIOS function that can be used for monitoring and modifying keystrokes

On the long list of user complaints about IBM equipment, the Enhanced keyboard has to rank very near the top. Personally, I don't mind the new keyboard layout. I use the CapsLock key more than the Ctrl key when I'm writing code, and the function keys across the top remind me of the old VT terminals. What I *don't* like is the placement of the Ins key near the Backspace key . . . but the point here is that we all have our gripes.

IBMFIX.COM, a small program that exchanged the actions of the CapsLock and Ctrl keys, was printed in the June 9, 1987, User-to-User column. This program intercepts the keystrokes before they get to the BIOS and toggles the flags that keep track of key presses.

To show there's more than one way to solve a problem, I wrote CTRLCAP.COM. This uses one of the advanced BIOS functions that were introduced with the PC AT to monitor and change the key scan codes before they got to the BIOS. Although it was possible, I didn't build in a test to see if the advanced BIOS functions were supported. There's a simpler test. If your computer's BIOS doesn't support the program, it won't work.

Each time a key is pressed or released, the keyboard generates an interrupt 9. This is its way of getting some CPU time to process the keystroke. When a key is pressed, the byte transferred is called a *make code*. When it's released, the corresponding *break code* is sent. Usually, the break code is 80h higher than the make code.

By default, interrupt 9 transfers control to a routine in the BIOS that translates the scan code into an action. This action includes changing a keyboard state, like CapsLock, setting a "key-pressed" flag, such as Alt, or putting a character in the buffer where applications can access it.

While any program monitoring interrupt 9 could retrieve the scan code, there was no way to change it on its way to the BIOS. To correct this, the AT BIOS was modified to include the function *Keyboard Intercept*. In this case, the BIOS *generates* the interrupt when it gets control, but before the scan code sent from the keyboard is interpreted. The AH register is set to 4Fh, and the scan code is put in AL. A program can chain into this interrupt and set up to monitor data passing through. CTRLCAP does this.

To make the operation of the program more clear, I've listed the assembly source code in Figure 1. (Figure 2 lists a BASIC program that will create CTRLCAP.COM.) By examining the code, it's easy to see what's happening. After terminating as a resident program, the program waits to be called by the BIOS. After verifying that AH contains 4Fh, CTRLCAP looks at the

```
;-----------------------------------------------------------------------
;  CTRLCAP - Reverse the CapsLock and Ctrl key on left side.
;       MASM CTRLCAP;
;       LINK CTRLCAP;
;       EXE2BIN CTRLCAP.EXE CTRLCAP.COM
;-----------------------------------------------------------------------
CSEG    SEGMENT PARA PUBLIC 'CODE'
        ASSUME  CS:CSEG                         ;Not sure of DS when resident

                ORG     100H                    ;SKIP TO END OF THE PSP
ENTPT:          JMP     SHORT INITIALIZE        ;COM FILE ENTRY ALWAYS AT 100H

        ;Change these codes to change two other keys
CTRL_DN         EQU     01DH                    ;Make for Ctrl
CAP_DN          EQU     03AH                    ;Make for CapsLock

COPYRIGNT       DB      "CTRLCAP 1.0 (c) 1988, Ziff Communications Corp."
                DB      13,10,"PC Magazine ",254," Robert L. Hummel"

NEW_INT         PROC    FAR                     ;Here is the new interrupt

                PUSHF                           ;Save flags
                CMP     AH,04FH                 ;If Kbd intercept fn
                JE      SWAP_0                  ; jump
                POPF                            ;Restore flags
                JMP     SHORT SPLICE            ;Continue to original
SWAP_0:
                POPF                            ;Discard flags
                PUSH    AX                      ;Save scan code
                AND     AL,07FH                 ;Eliminate high bit
```

(continues)

Figure 1: *The assembly code listing for the source file CTRLCAP.ASM, which exchanges the action of the CapsLock and Ctrl keys.*

■ PC TUTOR

```
                 CMP     AL,CTRL_DN                ;If not Ctrl key
                 JNE     SWAP_1                    ; jump

                 POP     AX                        ;Restore scan code
                 ADD     AL,(CAP_DN-CTRL_DN)       ; and change to other value
                 JMP     SHORT SWAP_EXIT           ;Leave
SWAP_1:
                 CMP     AL,CAP_DN                 ;If not CapsLock
                 POP     AX                        ; (restore scan code)
                 JNE     SWAP_EXIT                 ; then process normal

                 SUB     AL,(CAP_DN-CTRL_DN)       ; else adjust value
SWAP_EXIT:
                 STC                               ;Carry on=keep keystroke
SPLICE:
                 DB      0EAH                      ;JMP FAR
OLD_INT          DD      0                         ; old interrupt 15h

NEW_INT          ENDP

;=====================================================================
;        Initialization Procedure
;---------------------------------------------------------------------
INITIALIZE       PROC    NEAR
                 ASSUME  DS:CSEG                   ;Set by loader.

                 MOV     AH,9                      ;Display string fn
                 MOV     DX,OFFSET COPYRIGHT
                 INT     21H

                 MOV     AX,3515H                  ;Get current interrupt 15h
                 INT     21H                       ;Result in ES:BX

                 MOV     WORD PTR OLD_INT[0],BX    ;Save offset
                 MOV     WORD PTR OLD_INT[2],ES    ;Save segment

                 MOV     AX,2515H                  ;Set interrupt 15h
                 MOV     DX,OFFSET NEW_INT         ;Load DS:DX with our interrupt
                 INT     21H

                 MOV     AX,3100H                  ;Terminate & stay resident
                 MOV     DX,(OFFSET INITIALIZE-OFFSET CSEG + 15) SHR 6
                 INT     21H

INITIALIZE       ENDP

CSEG      ENDS
          END       ENTPT
```

(Figure 1 ends)

```
100 REM - BASIC PROGRAM TO CREATE CTRLCAP.COM
110 CLS:PRINT "Creating CTRLCAP.COM ": OPEN "CTRLCAP.COM " AS #1 LEN = 1
120 FIELD #1, 1 AS A$: CHECKSUM#=0
130 FOR I = 1 TO    10
140  LINESUM#=0: LOCATE 2,3: PRINT "Countdown: "    10 - I ;
150  FOR J = 1 TO  16: READ BYTE$: CHECKSUM#=CHECKSUM#+VAL("&H"+BYTE$)
160   LINESUM#=LINESUM#+VAL("&H"+BYTE$)
170   IF (BYTE < 256) THEN LSET A$=CHR$(VAL("&H"+BYTE$)): PUT #1
180  NEXT J
190  READ LINETOT$: LINECHECK# = VAL("&H"+LINETOT$)
200  IF LINECHECK# = LINESUM# THEN GOTO 220
210  LOCATE 4,2: PRINT "Error in line #"  ;  260 +  10 * I: GOTO 260
220 NEXT I
230 CLOSE: READ FILETOT$ : FILECHECK# = VAL(FILETOT$)
240 IF CHECKSUM# <> FILECHECK# THEN GOTO 260
250 PRINT: PRINT "CTRLCAP.COM  created successfully": SYSTEM
260 PRINT: PRINT "CTRLCAP.COM  is not valid!": END
270 DATA EB, 72, 63, 54, 52, 6C, 43, 41, 50, 20, 31, 2E, 30, 20, 28, 63,   4C0
280 DATA 29, 20, 31, 39, 38, 38, 2C, 20, 5A, 69, 66, 66, 20, 43, 6F, 6D,   43D
290 DATA 6D, 75, 6E, 69, 63, 61, 74, 69, 6F, 6E, 73, 20, 43, 6F, 72, 70,   65E
300 DATA 2E,  D,  A, 50, 43, 20, 4D, 61, 67, 61, 7A, 69, 6E, 65, 20, FE,   542
310 DATA 20, 52, 6F, 62, 65, 72, 74, 20, 4C, 2E, 20, 48, 75, 6D, 6D, 65,   544
320 DATA 6C, 9C, 80, FC, 4F, 74,  3, 9D, E8, 15, 9D, 50, 24, 7F, 3C, 1D,   6D0
330 DATA 75,  5, 58,  4, 1D, E8,  7, 3C, 3A, 58, 75,  2, 2C, 1D, F9, EA,   556
340 DATA  0,  0,  0,  0, E4,  9, BA,  2,  1, CD, 21, E8, 15, 35, CD, 21,   458
350 DATA 89, 1E, 70,  1, 8C,  6, 72,  1, 88, 15, 25, BA, 51,  1, CD, 21,   589
360 DATA E8,  0, 31, BA, 10,  0, CD, 21,  0,  0,  0,  0,  0,  0,  0,  0,   2A9
370 DATA 12817
```

Figure 2: *A BASIC program that will automatically create CTRLCAP.COM.*

scan code. If it finds the make code for the Ctrl key, it substitutes the make code for the CapsLock key. By doing the same for the break code, the BIOS thinks that the key has been switched.

After changes are made, control is passed to the old interrupt in case any programs may have chained in before us. The carry flag is used to communicate the disposition of the scan code to the BIOS. If carry is clear (0), the key is ignored. If the carry flag is set (1), it's processed.

You can determine the make and break codes for any key on the keyboard by using the SCAN.COM program presented in the October 27, 1987, PC Tutor. This will allow you to write your own program or change CTRLCAP to exchange any two keys (Ctrl and Alt, for example). You can also use the carry flag to ignore certain keys, such as PrtSc or Pause.

CTRLCAP is a memory resident program, so the best place to load it is the first line in your AUTOEXEC.BAT file. It will make the CapsLock key act just like the Ctrl key you're used to. It will also make *both* Ctrl keys act like the CapsLock key, and change the state of the keyboard.

Tracking down missing file space on a hard disk

I am using a Turbo-XT with a Seagate ST-225 20MB hard disk and DOS 3.1. When I run CHKDSK, it reports 17MB in 1,300 files, approximately 4MB to spare, and 7368 bytes in bad sectors. But, when I run a program like *XTree*, it tells me I am using 15.5MB in the same number of files. When I use *Fastback Plus* and back up all my files, I use about 43 disks, which is approximately 15.5MB.

Why is there a discrepancy between these programs? Which one is right? I've tried reformatting my hard disk but saw no improvement. How do I find how much free disk space I have? Is this a problem with my disk?—*Jacques Benoit; St. John's, Newfoundland, Canada*

Under DOS, disk space is managed by dividing it into minimum usable quantities known as clusters. A file is allocated a whole number of clusters, even if it doesn't fill the last one completely. The DOS DIR command, for example, reports the length of the file in bytes, not the total space required to store the file on the disk. This is the same number reported by *XTree* and copied by *Fastback*.

In your case, with a 20MB hard disk formatted under DOS 3.1, the disk will use clusters that are 2048 bytes (2K). Assume a random distribution of file sizes. On the average, each file will waste one-half of a cluster, or 1K. With 1,300 files on the disk, we can count on about 1.3MB of wasted space—the difference between the CHKDSK report and your other programs.

This "wasted" space is a result of the DOS file system and can't be recovered. It is worse under DOS 2.*x*, where the cluster size for a 20MB disk is 4K.

A correction regarding the COMSPEC environment variable

In the May 31, 1988, PC Tutor, you explained setting the COMSPEC environment variable. The text, however, contained an error. You listed

```
SET COMSPEC=C:\
```

when you should have listed

```
SET COMSPEC=C:\COMMAND.COM
```

If you don't list the name of the file in the COMSPEC, you're just as bad off as if you had named an invalid drive. DOS will never be able to load COMMAND when it needs it again.—*Wim Bonner; PC MagNet*

Leaving the name of the command processor out of the COMSPEC variable was an error. I apologize for any inconvenience this may have caused readers.

Ask the PC Tutor

The PC Tutor solves practical problems and explains points of general interest about using your hardware and software more productively, and answers basic questions about DOS and systems in general. To see your questions answered here, drop a line to PC Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016. We're sorry, but we cannot answer questions personally. PC

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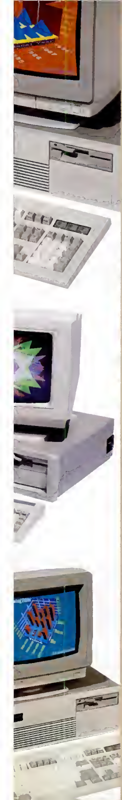

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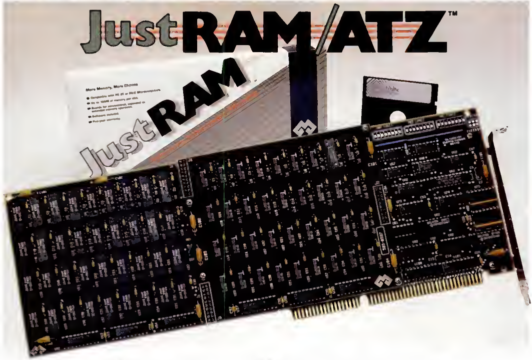

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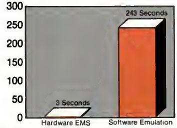

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CONNECTIVITY CLINIC

Recovering and adding memory to run software applications on networked PCs; simplifying network startup and controlling operations on each workstation with the batch file PCNET.

Simplify network start-up and operation using this comprehensive batch file

I run a ten-user network using IBM's *PC Local Area Network Program*. Until now, I've used an AUTOEXEC.BAT file on each workstation to start the network and I've had users attach and disconnect devices through different batch files. I had difficulty keeping track of which devices each workstation used, plus I had a lot of batch files to maintain. So I developed one batch file to control all network operations and access on each workstation. Each user starts the network by calling the PCNET .BAT file with the start (s) parameter. It provides an easy way for novices to get on and off the system and makes things easy for experienced users, but mainly it makes things easier for me!

This batch file uses the syntax of *PC LAN* software with the workstation running as a receiver.—*Andrea H. Durfee; Seattle, Washington*

The later versions of IBM's *PC LAN* software include menus that reduce the number of batch files you need, but the menus still can intimidate or frustrate users who aren't comfortable with the details of selecting printers and servers on a network.

New network administrators would be smart to follow this example. PCNET .BAT, shown in Figure 1, presents a simple menu of functions and then passes the commands to the LAN software needed to perform the selected function. You still

```
echo off
rem     /* decode argument - determine what user wants to do */
:BEGIN
        if .%1 == . goto DEFAULT
        if  %1 == c goto CONNECT
        if  %1 == C goto CONNECT
        if  %1 == d goto DETACH
        if  %1 == D goto DETACH
        if  %1 == s goto START
        if  %1 == S goto START
        if  %1 == v goto VIEW
        if  %1 == V goto VIEW

rem     /* no argument - give list of options */
:DEFAULT
        echo
        echo    Please Enter One of the Following NETS Commands
        echo
        echo    NETS C - To connect to network devices
        echo    NETS D - To disconnect from network devices
        echo    NETS S - To start network and connect to network devices
        echo    NETS V - To view list of connected network devices
        goto END

rem     /* show list of network devices currently connected */
:VIEW
        net use
        goto END

rem     /* start network and connect to network devices */
:START
        echo
        echo    Starting PC as Receiver on Network
        cd \network
        loadniu -r -d niuws.xfm stdlc > NUL
        niubios > NUL
        net start rcv USER > NUL
        if errorlevel 1 goto ERROR1
        goto CONNECT

rem     /* connect to network devices */
:CONNECT
        echo
        echo    Connecting PC to Network Devices
        net use E:    \\server\apps password > NUL
        if errorlevel 1 goto ERROR2
        net use lpt2: \\server\laser password > NUL
        if errorlevel 1 goto ERROR2
         goto END
```

(continues)

Figure 1: *This batch file controls starting up, connecting, and disconnecting from the network. Network start-up includes connecting to network devices. The process checks for errors such as a network's failing to start and network devices not attaching correctly.*

```
rem     /* detach from network devices */
:DETACH
        echo
        echo    Disconnecting PC from Network Devices
        net use E:    /d > NUL
        net use lpt2: /d > NUL
        goto END

rem     /* network system did not start properly */
:ERROR1
        cls
        echo                Network failed to start properly !!!
        pause
        goto END
rem     /* could not connect to network device */
:ERROR2
        cls
        echo                Network Connection Failed !!!!
        echo                 Contact System Administrator
        pause
        goto END
:END
```

(Figure 1 ends)

have to customize this batch file for each user and/or workstation, but at least you have only one batch file to worry about.

The commands shown in this example are specific to IBM's *PC LAN*, but since *PC LAN* is a version of Microsoft's *MS-Net*, they apply generally to other *MS-Net* derivatives.

PCNET.BAT is an excellent example of how to start and use a network when you don't have or want to use a built-in menu function. It lets inexperienced users access the network with less confusion and allows the network administrator more control.

Productivity Tip

There are two types of LAN operating systems: peer-to-peer (*10NET*, *LANtastic*, *PC LAN*), where workstations can contribute resources to the network; and dedicated server (Novell, 3Com, Banyan, Univation).

Alternatives that can give networked PCs more RAM for running applications

When we install IBM's *PC Local Area Network Program* as a file server, it takes at least one-third of the 640K memory. The accounting software we use requires the whole 640K. Can you recommend an economical and feasible solution? Please don't tell me to consult my dealer or the company that sold us the accounting software because I always get a runaround.

—Elias Ongpoy; Bakersfield, California

I don't know of any current alternative that lets you use a PC as a server and still have use of the full 640K for DOS and applications. Frankly, I also don't recommend this strategy. Your accounting package and the server software will steal too much memory from each other. You won't be happy with the performance of either one.

I suggest you run your application programs on networked PCs that store their shared files on the server. The redirector portion of *PC LAN* plus DOS will take about 180K of RAM on each client station.

If your network is very small, you might consider replacing it with *LANtastic Network Operating System* from Artisoft. The *LANtastic* network interface cards keep all but 13K of the program in their own RAM. The total cost is about $200 per node, and the software has more standard features (e-mail, for example) than IBM's *PC LAN*.

If you want to keep your present network, you can get that RAM back by using a HIcard from RYBS Electronics. The HIcard adds memory in the unused address spaces available below extended memory. Which HIcard model you buy (and its cost) will depend on factors such as which video board is in each PC. Different video cards use memory differently.

In the best case, a PC equipped with a monochrome board using a $250 HIcard can give you 256K added RAM. In the worst case, a PC with a retrofit VGA board using a $500 HIcard adds 112K RAM. The more expensive cards use many small-capacity memory chips that are able to take advantage of as little as 16K of open memory address space.

For more information contact:

Artisoft, 3550 N. First Ave., #330, Tucson, AZ 85719, (602) 293-6363;

RYBS Electronics, 2590 Central Ave., Boulder, CO 80301, (303) 449-9256.

Network Your Questions

Connectivity Clinic gives you practical solutions to networking problems of all types. We'll pay $50 or more for any tips we print, *plus an extra $25 if you submit your letter on a disk,* with a printout. We're sorry, but we're unable to answer letters personally.

Mail your contributions to Connectivity Clinic, *PC Magazine,* One Park Avenue, New York, NY 10016, or you may contact Frank J. Derfler, Jr., via MCI Mail (be sure to use Derfler's box named CONNECTIVITY CLINIC).

HOW TO SUCCESSFULLY BUY THROUGH MAIL ORDER AND PROTECT YOUR RIGHTS

Mail order sales are governed by rules of the Federal Trade Commission (FTC) and various state laws. These guidelines are published as a service to you. Remember, the many vendors advert ing in PC Magazine eager to serve your nee

FTC rules say:

1. The Seller must ship your order within 30 days of receiving it, unless the advertisement clearly states it'll take longer.

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TIPS WHEN ORDERING

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State precisely what merchandise you want, specifying details such as model, make, size, component parts, etc.;

Confirm the price and expected delivery date as stated in the ad;

Indicate whether you will accept a substitute product if the item you ordered is unavailable, and, if not, that your payment should be returned;

Don't send cash, you will have no record of payment if a problem arises, and;

Keep a copy of your order and all other correspondence with the Seller. Your records should include the company's name, address and phone number; a description of the item ordered; your cancelled check or a copy of the money order; record of the date you mailed the order; and any sales slips and shipping receipts.

When ordering by phone:

Note the time and date of your conversation and the name of the person you talk with;

Make a record of your order, the price, its promised availability and the components to be expected;

Save all correspondence associated with your order, including your cancelled check or a copy of the money order, and any written confir-
nation sent by the Seller.

uestions you should consider asking:

Does the advertised item come with all necessary parts and accessories? Are they from the same manufacturer?

Is it available for immediate shipping?. If not, when will it be available?

Has there been an increase in the advertised price?

What warranties does the item carry? Who provides the service?

What is the Seller's return policy?

What is the Seller's refund policy?

With whom should you correspond if there is a problem?

IF YOU HAVE PROBLEMS:

1. If you have not received your order as promised or if the item is defective, immediately notify the Seller in writing referring to your order by description, price, date, as well as by account number and order number, if available. Make sure you keep a copy of the letter.

2. If you complain by telephone, send a follow-up letter to confirm what was said.

3. If you think the merchandise is defective, reread your product instructions and your warranty carefully to be sure you don't expect features or performance the product isn't designed to give. Then contact the Seller for instructions. Don't return it to the Seller until you have been instructed to do so.

4. When returning merchandise make sure you keep the shipper's receipt or packing slip; your right to be reimbursed for postal cost is determined by store policy.

5. If you have completely discussed your problem with the Seller and are still not satisfied, write to the consumer complaint agency in the Seller's state. If you paid for the merchandise by credit card, you may have rights to withhold payment under a Federal law called the Fair Credit Billing Act.

PC Magazine's Direct Marketing Connection For PC Products and Services

For many of you, mail order is your primary means of purchasing PC products and services.

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104	Canen A-1200	4.95
113	Centronics 150/152	2.45
109	Centronics 350/351/352/353	9.35
112	Centronics 704/705/753	4.95
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Memory 3MB: T3200	1239/1200
Memory 2MB: T5100	1049/1020
Modem 1200 Int: T1000	319/300
Modem 1200 No Slot: T1200	299
When installed	350
Modems: T1100+/1200/3120/5100	
Toshiba 1200 Int	299/280
MultiTech 1200 Int w/sw	239/220
Prometheus 1200 Int +sw	199/185
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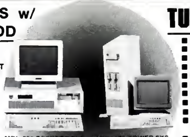
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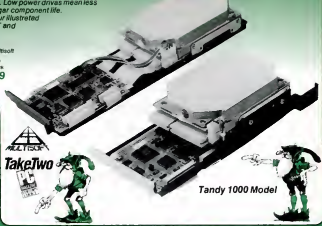

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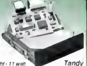

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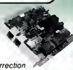

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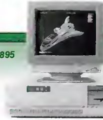

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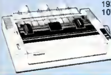

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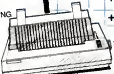

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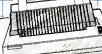

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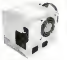

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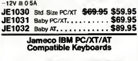

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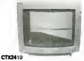

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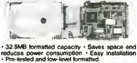

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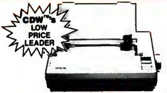

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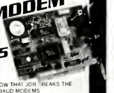

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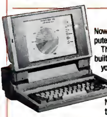

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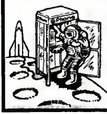

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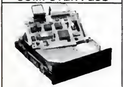

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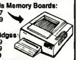

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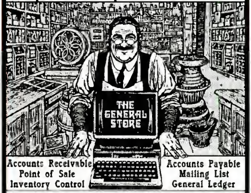

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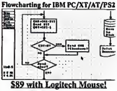

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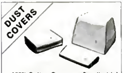

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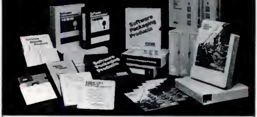

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COMING UP

SMALL-FOOTPRINT 386s *PC Magazine*'s editors use a battery of PC Labs benchmark tests to evaluate the latest in small-footprint PCs. Find out whether you have to sacrifice power and speed to free up more space on your desk as they examine the internal architecture of seven new PCs—including IBM's PS/2 Model 70, Compaq's 386S, and Arche Technologies' Rival 386.

CHALLENGING 1-2-3 As Lotus delays the latest version, Release 3.0, of its industry standard spreadsheet, four competitors for the corporate market have upped the ante with powerful new packages. Jared Taylor compares the most recent versions of *Quattro*, *Excel*, *Surpass*, and *VP-Planner Plus*, to ascertain how much they offer the corporate user beyond what is available in *1-2-3*, Release 2.01. PC MagNet polls our readers to find out what they want out of their spreadsheets. We also explore some interesting alternatives to the standard spreadsheet.

NETWORKED DATABASES Our resident workgroup computing expert, Frank J. Derfler, Jr., explores the problems arising from simultaneous file access by multiple users. We review 20 networked programmable databases including *dBASE III Plus*, *R:Base*, *FoxBASE Plus/LAN*, *Advanced Revelation*, *Paradox Network Pack*, and *Clarion Professional Developer*. Our editors examine log file architecture versus the DOS file- and byte-locking method of sharing data on a network. How do they work, and what are the advantages and disadvantages of using either method?

LOW-END PROJECT MANAGERS The new generation of affordable project management software is easier to use and more powerful. Is it enough, however, for today's corporate users? Henry Fersko-Weiss rates *Micro Planner for Windows*, *Microsoft Project*, *SuperProject Plus*, *Time Line*, and *Harvard Project Manager* on improved cost reporting, as well as enhanced graphing of project flow and resource utilization.

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PC 10/31-4

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v. ☐ In 6 to 12 months
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AFTER HOURS

GAMES

Unlock Gamemaster: Setting Free the Games

BY JENNIFER ZAINO

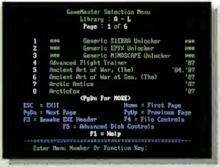
While many business programs have been freed from the bonds of copy protection, most computer games are still restrained under its yoke. Some copy protection schemes make it impossible to install the software on a hard disk drive, while others send you scrambling for a master disk every time you start the game. And let's not forget that some games are *still* not available on 3½-inch disks.

Enter TranSec Systems' *Unlock Gamemaster*. The $39.95 program will remove copy protection from over 60 of the most popular computer games, including *Chessmaster 2000*, *The Ancient Art of War*, and *California Games*. The program also includes generic unlockers for most Sierra and Epyx games.

The program doesn't alter your original disks; you'll still have the copy-protected version when the unlocking process is complete. But you'll also have a spanking new *un*-copy-protected version on a separate floppy or your hard disk.

Unlock Gamemaster is simple to use. However, the fact that you must first unload *all* your RAM-resident programs and device drivers from memory is somewhat inconvenient.

Since *Unlock Gamemaster* has a specific canned program to undo copy protection for each game (except for those supported by the generic unlockers), you'll have to page through the 11 menu screens to select the program you wish to unlock. If you're using one of the generic unlockers, you'll have to enter the name of the key (.EXE or .COM) file. *Gauntlet*, *Mean 18 Golf*, and *Chuck Yeager's Advanced Flight Trainer* also require that you perform a few additional steps, which are outlined in the manual.



```
                 GameMaster Selection Menu
                      Library : A - L
                       Page : 1 of 6

   1    ***        Generic SIERRA Unlocker          ***
   2    ***        Generic EPYX Unlocker            ***
   3    ***        Generic MINDSCAPE Unlocker       ***
   4    Advanced Flight Trainer                     '87
   5    Ancient Art of War, (The)               '84,'87
   6    Ancient Art of War at Sea, (The)            '87
   7    Arctic Antics                               '87
   8    Arcticfox                                   '87
                       <PgDn For MORE>
ESC  = EXIT                        Home = First Page
PgDn = Next Page                   PgUp = Previous Page
F3 = Remake EXE Header             F4 = File Controls
              F5 = Advanced Disk Controls
                        F1 = Help
 ----==============================================----
   Enter Menu Number Or Function Key:
```

It's easy to master Unlock Gamemaster*'s simple user interface. Just page through the 11 menu screens, select the game you wish to unlock, and you're ready to go.*

Ironically enough, TranSec employs a mild copy-protection scheme. You can't get into the program unless you supply a word from a page and a line number it generates at random.

Unlock Gamemaster is the answer to computer-game-players' prayers, as long as they were praying for a program that will let them make *legal* uncopy-protected backups of software they already own.

List Price: *Unlock Gamemaster*, $39.95; quarterly updates, $15.
Requires: 256K RAM, two disk drives or hard disk, DOS 2.1 or later. Copy protected. TranSec Systems Inc., 220 Congress Park Dr., #200, Delray Beach, FL 33445; (407) 276-1500.

CIRCLE **615** ON READER SERVICE CARD

GAMES

Pinball Wizard Demands Quick Flicks Of Supple Wrists

BY FREDRIC BURKE

Admit it. You like to play pinball. You probably even fancied yourself pretty good at it, too—until pinball machines, squeezed out of arcades by the likes of *PacMan* and *Frogger* video games, became harder to find. And the ones you did find weren't challenging enough to be worth the effort.

If the current generation of real pinball machines isn't to your liking, *Pinball Wizard*, a neat $34.95 simulation from Accolade, may well win you over. Its EGA graphics are crisp and bright, and it is a very convincing representation of the real thing.

You can use a mouse with the program, but the company recommends using the keyboard to control game play. Pressing down on both Shift keys literally gets the ball rolling. Left and right flipper action is similarly controlled by the corresponding Shift keys.

You can vent your frustrations by banging on the machine with the CapsLock, Alt, and Spacebar keys, or just hold the ball on the flippers: play it like you would a real pinball machine, and you'll keep coming back for more.

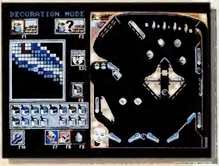
Pinball Wizard really begins to shine in construction mode. Here you can change the game layout to suit your tastes. You can alter just about anything that affects the character of the game—from the tilt of the playing surface to the number of balls per game and more. This level of versatility virtually ensures that the only way you'll ever play the same screen twice is if you save it.

The downside to all this is the major inconvenience of having to reboot in order to exit. Despite this, *Pinball Wizard* is a solid, well-done game that is, quite simply, a scream to play. Lose the ball between the flippers just once, and you'll be hooked.

List Price: *Pinball Wizard*, $34.95 (for 3½- or 5¼-inch disks).
Requires: 256K RAM (348K for Tandy 1000/1000EX); one disk drive; CGA, EGA, or Hercules MGA; DOS 2.0 or later. Copy protected. Accolade, 550 So. Winchester Blvd., San Jose, CA 95128; (408) 296-8400.

CIRCLE **614** ON READER SERVICE CARD

In Pinball Wizard*'s paint mode, you can add character to your game, perhaps by drawing a blue mustache on the girl on the machine.*



Lucasfilm's Maniac Mansion Adds a New Twist to On-line Adventure

BY STEPHANIE K. LOSEE

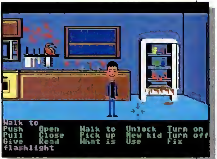
The scenario: You're playing a Sierra On-Line–style adventure game. You walk your character through three screens and find yourself trapped: you can go no further until you find the puzzle's missing pieces. You furiously type commands worded in every different way you can imagine. Nothing works. You reach for the hint book, but then you remember that you forgot to send away for it. After 3 hours of failed attempts you leave the room, vowing to return when your body is rested and your mind is clear.

Tired of trying to outwit the programmer? Lucasfilm Games presents lovers of graphic adventure games with a choice. *Maniac Mansion*, Lucasfilm's first game for the PC, is not a preplotted puzzle, but a cinematic sci-fi mystery set in a 40-room stage. And you, not the programmer, are the director of your adventure.

The plot: Dr. Fred, a mad scientist holed up in his Addams Family–style house, has kidnapped your friend Sandy for the diabolical purpose of sucking her brains out. You and two of your pals must foil his plan by befriending two of Dr. Fred's coconspirators, Weird Ed and the Green Tentacle, and turning them against him.

Unlike standard graphic adventure games, *Maniac Mansion* doesn't force the player to solve a set of puzzles in order to move to the next set of screens. Instead, nearly every room in the house is open to you from the beginning. You no longer have to worry about getting bumped off at every turn, nor must you concern yourself with saving the game each time you make progress.

In designing the game, the Lucasfilm folks avoided a problem that general manager Stephen D. Arnold terms "metagaming": activities during play that "take the player out of the game." Their theory is that searching for vocabulary, trying to anticipate traps, and constantly saving the game remove the player from the story line. The result of their redesign is a plot-oriented (rather than puzzle-oriented) game set in a wonderfully forgiving environment.



You'll have to appease the Tentacle Monster's voracious appetite by picking up some goodies from the fridge; beware, however—those innocent-looking kitchen knives behind you are Nurse Edna's favorite playthings.

As befits Lucasfilm's status in the movie business, the company injected many cinematic elements into game play. Start up the game, and a "filmed" scene accompanied by rap music introduces you to the plot. As you wander through the house, "cut scenes" interrupt play, moving the plot along and keeping you up to date on Dr. Fred's brain-drain scheme.

You play Dave, Sandy's boyfriend, and your first step is to choose two friends to aid you in your mission. Each of the seven "kids" has different abilities, so each team you set up can take advantage of different sets of plot problems.

At the bottom of the *Maniac* screen is a list of 15 action words; you can string these together and link the commands to objects on the screen. No more searching for vocabulary! When you pick up items along your journey, they appear at the base of the screen, ready for use.

The expertise needed to reason out the game's complex solutions to problems can be high. It's often difficult to know early on what role certain activities will play in the final rescue of Sandy. The game is not meant to be played once and put on the shelf. Instead, players must spend their first game just learning the environment and gaining experience before they can divine a large-scale solution for Sandy's plight.

Maniac Mansion is not without its faults. The characters have absurdly large heads whose colors often happen to be the same as the wallpaper, resulting in a now-you-see-him-now-you-don't effect.

Another annoyance is a dungeon into which your characters are constantly being thrown by Weird Ed and Nurse Edna. This reduces your task force to two members, as one kid must stay in the dungeon to release the others by pushing a trick brick found in the wall.

Lucasfilm's *Maniac Mansion* boasts a wicked sense of humor and brings the word *suspense* into the computer game vocabulary. Now if they'd just install a Boss key . . .

List Price: *Maniac Mansion*, $44.95; Hint Book, $7.95.
Requires: 256K RAM; CGA, EGA, VGA, MCGA, or Hercules; mouse or joystick optional. Copy protected. Lucasfilm Ltd., Games Division, P.O. Box 2009, San Rafael, CA 94912; (415) 662-1800.

CIRCLE **613** ON READER SERVICE CARD

Copy Protection: The Civilized Way

Lucasfilm's *Maniac Mansion* makes use of a new copy-protection scheme that actually makes sense. Nocopi paper, from Nocopi International Inc. in Toronto (416-928-6888), could even be a *good* thing for honest computer game players everywhere.

By printing crucial information on this dark-purple paper, a game manufacturer can make it virtually impossible to copy the manual's pages with standard photocopying and fax machines. While other games also have crucial information in the manual, an energetic copier can reproduce the documentation. Nocopi makes it possible to limit illegal distribution of games without using clumsy disk-based protection. It also goes a long way toward making users' lives easier.

The scheme is effectively put to work in *Maniac Mansion*: a door shuts one or more times during the game, at which point you must enter a code from the Nocopi sheets in the manual to continue. Lucasfilm has indicated to Nocopi International that it intends to use the paper in future products as well.
—Philip F. H. Rose

AFTER HOURS

GAMES

To Catch a King: East Meets West in the Game of Chess

BY ROBERT NISONOFF
AND
M. STEPHANIE RICKS

The game of chess originated thousands of years ago in India and Persia, and since then it has held a fascination for players around the world. Its adoption and consequent adaptation by diverse peoples are reflected in the two programs reviewed here. While *EGA Chess* is played according to Western rules, with which most of us are at least acquainted, *Xian* is based upon a less familiar, Far Eastern interpretation.

EGA Chess

From the West (Cube Microsystems in Kansas, to be exact) comes *EGA Chess*, an evenly paced, richly accessorized, and challenging program that approaches the game of chess in a relentless manner.

All of the game features, such as playing as black or white, reviewing previously played games, and rotating the board between human opponents for an accurate user perspective, are accessed by function keys. Moves are entered painlessly with standard algebraic notation.

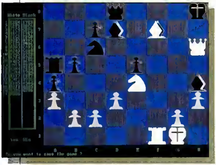
The colors on *EGA Chess* are brilliant. There is no chance that you will confuse pieces, the playing board, or text because the graphics are clear and well illustrated.

EGA Chess even functions as a referee between two players. As an opponent, *EGA Chess* had a good repertoire of openings and understood the basic aspects of the game. While it played logically, it did not learn from its mistakes. This flaw made it possible to win the exact same way during separate games at the default level.

At its lower levels *EGA Chess* consistently made workmanlike, if uninspired, moves. The quality of play at the higher levels improved considerably, but the pace of the game slowed to a crawl when the program was left to its own devices. You'll have to press the Spacebar to force an immediate tactical response from the game.

The game has an on-line tutorial that includes animated explanations of moves such as castling and en passant for players still wet behind the ears.

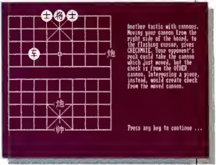
At $69.95, *EGA Chess* is $30 more than *The Chessmaster 2000*, one of the most popular chess games on the market.



Do you want to save the game ?

***EGA Chess** is soundly trounced by a bishop sacrifice at level one. It did show a "terminator" like determination to win, but in the end it was outmatched.*

Xian's on-line tutorial offers tactical suggestions on maximizing the cannon's (pao's) effectiveness, whose moves mirror the rook's (ju's) except when capturing another piece.



```
Another tactic with cannons.
Moving your cannon from the
right side of the board, to
the flashing cursor, gives
CHECKMATE. Your opponent's
rook could take the cannon
which just moved, but the
check is from the OTHER
cannon. Interposing a piece,
instead, would create check
from the moved cannon.

Press any key to continue ...
```

While *EGA Chess* does not offer as many playing features as *The Chessmaster 2000*, it is sure to provide overall playing pleasure and challenging gamesmanship.

List Price: *EGA Chess*, $69.95.
Requires: 512K RAM, one disk drive, EGA or VGA, DOS 2.0 or later. Not copy protected. Cube Microsystems, P.O. Box 26064, Overland Park, KS, 66225; (913) 649-6747.

CIRCLE 617 ON READER SERVICE CARD

Xian

Lao-Tzu, an ancient Chinese philosopher, once said, "A journey of 1,000 miles must begin with a single step." *Xian*, a Chinese chess program, embodies that principle: this is not an easy game.

Xian, a $34.95 program from Leong Jacobs Inc., is based on the rules of Chinese chess—rules that have remained virtually unchanged for the last 400 years.

Two opponents begin the game with 16 chess pieces each: one king; pairs of mandarins, elephants, horses, rooks, and cannons; and five pawns. The game is played on a standard-sized "board" with ten horizontal lines crisscrossed by nine vertical lines. A "river" bisects the board and restricts the movement of the elephants.

Both sides battle to capture their rival's kings or to stalemate the game—which also results in victory for the player who was last able to move.

Chinese chess differs significantly from Western chess. For example, in Chinese chess, the king is always exposed and cannot leave his palace, a triangular enclosure; pawns cannot be promoted to other pieces; and the horse, which is similar to the knight in Western chess, cannot jump over other board pieces. One potential source of confusion is that identical pieces on opposing sides are sometimes represented by different Chinese characters.

Xian has an extensive on-line tutorial and eight playing levels, so as you progress the game gets more challenging.

Unfortunately, *Xian*'s graphics are unappealing. The game is available only in a monochrome version, and the "board" is ridiculously small, taking up only about a third of the screen. But that shouldn't bother true chess devotees, who will probably welcome the opportunity to learn about this Far Eastern style of chess.

List Price: *Xian*, $34.95.
Requires: 256K RAM, one disk drive, DOS 2.0 or later. Copy protected. Leong Jacobs Inc., 2729 Lury Lane, Annapolis, MD 21401; (301) 266-3660.

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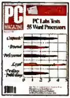

2/29/88—PC Labs tests 55 word processors; 1987 tax prep software; IBM's 20-MHz PS/2 Model 80 benchmarked; living with laser printers; keyboard monitors under OS/2; 1-2-3 competitor Surpass; PC MacTerm; Primetime Personal time-management software; OS/2 ThinkTank upgrade; Connex comm software; more.

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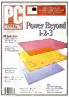

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PC MAGAZINE AFTER HOURS

GAMES

Into the Wild Blue Yonder with Microsoft Flight Simulator 3.0

BY JEFF PROSISE

Legions of armchair pilots have earned their wings at the controls of Microsoft's original *Flight Simulator* for the PC. Now *Flight Simulator* 3.0, the first major update of the product in over 4 years, lets you soar to new heights with a wealth of new features and enhancements.

The latest *Flight Simulator* offers crisp 640 by 350 graphics with 16 colors on systems equipped with EGA or VGA video hardware. Copy protection has been removed so that the software may be installed on and run from a hard disk.

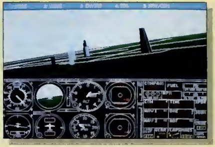
Besides letting you pilot the fully instrumented Cessna 182 offered in the original version, *Flight Simulator* 3.0 now lets you take off in a World War I vintage Sopwith Camel or an ultrafast Gates Learjet. And players linked by modem or null modem cable can roam the skies together with each pilot's plane visible on the screens of the other players.

Flight Simulator is unparalleled in its realism. Its world consists of the continental United States surrounded by parts of Canada, Mexico, and the Caribbean. More than 100 airports in five metropolitan areas—New York/Boston, Chicago, Seattle, Los Angeles, and San Francisco Bay—let you practice flying and navigation over a variety of terrain. Other airports can be added by purchasing scenery disks. The same scenery disks you used with the old *Flight Simulator* can be used again with Version 3.0.

Flight Simulator now offers four different views: *cockpit view* puts you in the pilot's seat and lets you scan the horizon in eight different directions; *tower view* displays your plane as you would see it from the control tower; *spot view* shows the plane as seen from a spot plane that follows it at the angle, distance, and elevation you specify; and *trace view* keeps your sight tuned to another plane in multiplayer mode.

Any two views can be shown at once. A third window shows a view looking straight down, especially useful for taxiing around airports. Landings are more dramatic than ever with the added perspective of the spot view window, where you can watch the plane settle gently down until it meets its shadow on the runway below.

The user interface has been reworked to include five pull-down menus that offer fast access to all features. Mice and joysticks are supported but not required.



You can pilot Flight Simulator'*s Cessna 182 over the downtown Chicago area, but you'll have to get off the runway at Meigs Field first.*

Flight Simulator 3.0 is much more than just a game. Pilots can practice flying under VFR or IFR conditions complete with variable degrees of aircraft reliability, wind, cloud cover, and turbulence. *Flight Simulator* will even log all of your flights into a disk-based logbook; it can also analyze and replay your flights, landings, maneuvers, and crashes.

But above all, *Flight Simulator* is *fun*! A new entertainment menu lets you dogfight other enemy aircraft in your Sopwith Camel, race against the clock in a crop-dusting simulation, play follow-the-leader with other planes as they weave between the bridges and buildings of San Francisco, and test your skills by landing on the deck of an aircraft carrier. At $49.95, *Flight Simulator* 3.0 is the software deal of the year.

List Price: *Flight Simulator* 3.0, $49.95. **Requires:** 256K RAM; one disk drive or hard disk; DOS 2.0 or later; CGA, EGA, MCGA, VGA, or Hercules Graphics Adapter. Not copy protected. Microsoft Corp., 16011 NE 36th Way, Box 97017, Redmond, WA 98073-9717; (206) 882-8080.

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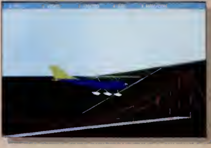

This view shows the plane (here whizzing over the Golden Gate Bridge) as seen from a spot plane following at a specified angle.

AFTER HOURS INDEX

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Electronic Chess: Eastern and Western style
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